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Subsurface Exploration, Geologic Hazard,
and Geotechnical Engineering Report

ISSAQUAH HIGH SCHOOL #4 AND ELEMENTARY SCHOOL #17

Issaquah, Washington

Prepared For:

ISSAQUAH SCHOOL DISTRICT

Project No. 20180070E001
September 17, 2019; Revised June 17, 2021

Associated Earth Sciences, Inc.
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September 17, 2019
Revised June 17, 2021
Project No. 20180070E001

Issaquah School District
5150 220th Avenue SE
Issaquah, Washington 98029

Attention: Mr. Tom Mullins

Subject: Subsurface Exploration, Geologic Hazard,
and Geotechnical Engineering Report
Issaquah High School #4 and Elementary School #17
4221 228th Avenue SE
Issaquah, Washington

Dear Mr. Mullins:

We are pleased to present our geotechnical engineering report for the referenced project. This report summarizes the results of our subsurface exploration, geologic hazards, and geotechnical engineering studies, and offers recommendations for the design and development of the proposed project.

We have enjoyed working with you on this study and are confident that the recommendations presented in this report will aid in the successful completion of your project. If you should have any questions or if we can be of additional help to you, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Stephen A. Siebert, P.E.
Associate Geotechnical Engineer

SAS/ms/ld - 20180070E001-011

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SUBSURFACE EXPLORATION, GEOLOGIC HAZARD, AND GEOTECHNICAL ENGINEERING REPORT

ISSAQUAH HIGH SCHOOL #4 AND ELEMENTARY SCHOOL #17

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Issaquah School District
5150 220th Avenue SE
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I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of Associated Earth Sciences, Inc.'s (AESI's) subsurface exploration, geologic hazard, and geotechnical engineering study for the new Issaquah High School #4 and Elementary School #17. Our understanding of the project is based on review of civil plans prepared by AHBL which show the proposed grading and building locations. The site location is shown on the "Vicinity Map," Figure 1. An aerial photo of the site showing the approximate locations of the explorations completed for this study is included on Figure 2. The exploration locations and the locations of the proposed improvements are shown on Figure 3. Copies of the exploration logs are included in Appendix A.

1.1 Purpose and Scope

The purpose of this study was to provide subsurface data to be utilized in the preliminary design and development of the referenced project. Our study included reviewing available geologic literature, advancing 40 exploration pits and 12 exploration borings, and performing geologic studies to assess the type, thickness, distribution, and physical properties of the subsurface sediments and groundwater. Geotechnical engineering studies were completed to formulate preliminary recommendations for site preparation, grading, types of suitable foundations and floors, allowable foundation soil bearing pressure, anticipated foundation and floor settlement, drainage considerations, pavement recommendations, construction of athletic fields, and infiltration feasibility. This report summarizes our fieldwork and offers preliminary recommendations based on our present understanding of the project. We recommend that we be allowed to review the recommendations presented in this report and revise them, if needed, when a project design has been finalized.

1.2 Authorization

Our study was accomplished in general accordance with our scope of work and cost proposal, dated November 2, 2018. This report has been prepared for the exclusive use of the Issaquah School District and their agents for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering and engineering geology practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made.

2.0 PROJECT AND SITE DESCRIPTION

The subject site consists of three parcels totaling approximately 40 acres located at 4441, 4443, and 4461 228th Avenue SE in Issaquah, Washington (King County Parcel Nos. 1624069001, 1624069029, and 1624069031). Access to the site is gained via two paved driveways off 228th Avenue SE. The site is located adjacent to the Providence Point neighborhood, which borders the site to the north, south, and west. The site is bounded to the east by 228th Avenue SE, beyond which lies the Sammamish Highlands neighborhood.

As shown on Figure 2, the site generally consists of an elevated relatively flat to gently sloping plateau located in the central portion of the site. The topography generally slopes down from the central plateau toward the northeast, south, and southwest. Elevations on the site range from a low of approximately 415 feet near the northeastern corner of the site to a maximum of approximately 526 feet in the southern portion of the site. The property was previously developed with a church, dormitories, and accessory buildings. These structures were in the process of being demolished during our initial phase of field exploration in December 2018, but demolition had been completed by the time of our second phase of exploration in June of 2019. It should be noted that the topographic contours shown on Figure 2 are based on Light Detection and Ranging (LIDAR) data and reflect topographic conditions at the site prior to the recent building demolition. The locations of the former buildings are shown on Figure 2. The topography in the former building areas was altered during demolition. Current (post-demolition) topography is shown on Figure 4.

Slope inclinations on the site generally range from approximately 30 percent or less but steepen to a maximum of approximately 50 percent in several areas. Those portions of the site with slope inclinations exceeding 40 percent are shown on Figure 4. With the exception of an area located near the southeast corner of the property, those areas of the site with slope inclinations exceeding 40 percent are less than 15 feet in maximum height. The steep (greater than 40 percent) slope located near the southeast corner of the site has a maximum height of approximately 35 feet. With the exception of several small, isolated steep slope areas located southwest of the former building locations, all of the steep slopes on the property are interpreted to have been created by previous grading associated with road, driveway, and parking lot construction or the recent building demolition.

A water tank located in the southern portion of the site remains in place.

Project plans consist of construction of a new high school and elementary school. The high school building will be located in the southern portion of the site and the elementary school building in the western portion of the site. The high school will have a football field and track, baseball and softball fields, tennis courts above a parking structure, surface parking, and space for future portable classrooms. The elementary school will have play areas, surface parking, and space for future portable classrooms. The proposed facility layout is shown on Figure 3.

Maximum cuts for the project will be up to approximately 17 to 18 feet and will be located in the southern portion of the site in the area of the proposed high school building. A maximum fill depth of approximately 41 feet will be located in the northeastern portion of the site in the area of the proposed baseball field. We understand that current grading plans include the use of mechanically stabilized earth (MSE) walls to facilitate proposed grade changes in some areas. Grading plans for the project include construction of retaining walls with maximum heights of approximately 19 feet along the southwest site margin and in the northeastern portion of the site in the area of the baseball field. Existing slope inclinations in these areas range from approximately 10 to 25 percent.

The civil plans show six stormwater detention facilities planned across the site. The detention facilities consist of prefabricated StormTank® modules, or a similar underground detention system, that will be located below the elementary school building play area, below the high school football and baseball fields, below a traffic loop south of the high school building, and in an area in the northeastern portion of the site.

3.0 SUBSURFACE EXPLORATION

Our field study included advancing 40 exploration pits and 12 exploration borings at the site. This information was supplemented by 20 additional exploration pits completed at the site for previous geotechnical studies by Terra Associates, Inc. (Terra) in July 2015 and by Earth Solutions NW (ESNW) in May 2014. These exploration logs were included in a report titled "Geotechnical Report, Madison Pointe," prepared by Terra for Murray Franklyn Companies, Project No. T7252, dated March 18, 2016. A copy of this report was provided to us by the District. It should be noted that the log of ESNW exploration pit TP-2 was not included in the report. The approximate locations of the explorations are shown on Figures 2 and 3. The conclusions and recommendations presented in this report are based on the explorations completed for this study. The number, locations, and depths of our explorations were completed within site and budgetary constraints. Copies of the exploration logs are included in Appendix A.

Because of the nature of exploratory work below ground, extrapolation of subsurface conditions between field explorations is necessary. It should be noted that subsurface conditions between the explorations may differ from those inferred by the boring data due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of any variations between the field explorations may not become fully evident until construction. If variations are observed at that time, it may be necessary to re-evaluate specific recommendations in this report and make appropriate changes.

3.1 Exploration Pits

The exploration pits were excavated using a track-mounted excavator. The pits permitted direct, visual observation of subsurface conditions. Materials encountered in the exploration pits were studied and classified in the field by an engineering geologist from our firm. All of the exploration pits were backfilled immediately after examination and logging. Samples collected from the exploration pits were classified in the field and representative portions placed in watertight containers. The samples were then transported to our laboratory for further visual classification and laboratory testing.

3.2 Exploration Borings

The exploration borings drilled for our study were completed using a track-mounted, hollow-stem auger drill rig. During the drilling process, samples were generally obtained at 2.5- to 5-foot-depth intervals. The exploration borings were continuously observed and logged by an engineering geologist from our firm. The exploration logs presented in Appendix A are based on the field logs, drilling action, and review of the samples collected.

Disturbed, but representative samples were obtained by using the Standard Penetration Test (SPT) procedure in accordance with *ASTM International* (ASTM) D-1586. This test and sampling method consists of driving a standard 2-inch, outside-diameter, split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded, and the number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance ("N") or blow count. If a total of 50 is recorded within one 6-inch interval, the blow count is recorded as the number of blows for the corresponding number of inches of penetration. The resistance, or N-value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils; these values are plotted on the boring logs in Appendix A.

The samples obtained from the split-barrel sampler were classified in the field and representative portions placed in watertight containers. The samples were then transported to our laboratory for further visual classification.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the project site were inferred from the field explorations accomplished for this study, visual reconnaissance of the site, and review of selected geologic literature. Detailed descriptions of the sediments encountered in each of the borings are provided on the exploration logs in Appendix A. The explorations generally encountered natural sediments consisting of granular, glacial sediments underlain by weathered sedimentary rock. Fine-grained glacial sediments and/or glacially consolidated non-glacial sediments were also encountered in some locations. In some areas of the site, the natural deposits were overlain by fill soils. The following section presents more detailed subsurface information organized from the shallowest (youngest) to the deepest (oldest) sediment types.

4.1 Stratigraphy

Fill

Fill soils (those not naturally deposited) were encountered in 11 of the explorations at the site. Where encountered, the existing fill generally consisted of loose to dense, gravelly, silty to very silty sand. Portions of the fill contained trace to abundant quantities of wood debris. In general, the areas where existing fill soils were encountered were located near the former buildings, pavement areas, and property margins. Where encountered in our explorations, the existing fill soils ranged in thickness from approximately 1 to 9 feet.

Excavated existing fill material is suitable for reuse in structural fill applications if such reuse is specifically allowed by project plans and specifications, if excessively organic and any other deleterious materials are removed, and the moisture content is suitable for compaction to the specified level. Because of its variable, and sometimes low relative density, the existing fill soil is not suitable for support of building foundations or other structures. The thicknesses of the existing fill soils encountered in the explorations are summarized in Table 1.

Table 1
Summary of Observed Fill Thicknesses

Exploration	Fill Thickness (feet)
EP-7	1
EP-8	8
EP-9	1
EP-11	6
EP-16	4
EP-18	2
EB-4	2.5
EB-8	4.5
EB-9	2.5
TP-6 (Terra, 2015)	1
TP-5 (ESNW, 2014)	9

Forest Duff/Topsoil

A surficial forest duff/topsoil horizon was encountered in most of our explorations located outside of areas of existing fill or asphalt pavement. Where encountered in our explorations, the thickness of the forest duff/topsoil horizon generally ranged from approximately 2 inches to 1.5 feet. Organic topsoil thicknesses shown on the Terra and ESNW exploration logs generally ranged from approximately 6 inches to 2 feet. Due to its high organic content, the forest duff/topsoil horizon is not suitable for foundation support or for use as structural fill.

Vashon Lodgement Till

With the exception of exploration pits EP-4, EP-39, and EP-40, the natural sediments encountered in our exploration pits either directly below the ground surface, the surficial topsoil horizon, or the surficial fill layer generally consisted of loose to medium dense, non-stratified, silty to very silty, gravelly sand with scattered cobbles. These sediments typically became dense to very dense below depths ranging from approximately 6 inches to 6 feet. We interpret these sediments to be representative of Vashon lodgement till. The Vashon lodgement till was deposited directly from basal, debris-laden, glacial ice during the Vashon Stade of the Fraser Glaciation, approximately 12,500 to 15,000 years ago. The high relative density characteristic of the Vashon lodgement till is due to its consolidation by the massive weight of the glacial ice from which it was deposited. The reduced density observed in the upper portion of the till is interpreted to be due to weathering.

Lodgement till sediments were also encountered in the upper portions of exploration borings EB-1, EB-2, EB-5 through EB-9, EB-11, and EB-12, and appear to have been encountered in all of the ESNW and Terra exploration pits except Terra pit TP-6. The Terra and ESNW exploration logs do not consistently identify the geologic units encountered. However, in their report, Terra describes these sediments as consisting of lodgement till. At the locations of exploration borings EB-5, EB-8, EB-11, and EB-12, and in Terra pits TP-4, TP-5, and TP-8, the till extended to depths ranging from approximately 2 to 28 feet. Where encountered elsewhere in the explorations, the till extended beyond the maximum depths explored of approximately 4.5 to 15.5 feet. Exploration borings EB-1, EB-2, and EB-7 met with driller refusal in the till at depths of approximately 10 to 15.5 feet. In addition to cobbles, lodgement till typically contains scattered boulders and the difficult drilling conditions encountered at these locations are likely due to the presence of boulders and/or clusters of cobbles in the till.

Lodgement till typically possesses high-strength and low-compressibility attributes that are favorable for support of foundations, floor slabs, and paving with proper preparation. Lodgement till is silty and moisture-sensitive. In the presence of moisture contents above the optimum moisture content for compaction purposes, lodgement till can be easily disturbed by vehicles, earthwork equipment, and even foot traffic. Careful management of moisture-sensitive soils, as recommended in this report, will be needed to reduce the potential for disturbance of wet lodgement till soils and costs associated with repairing disturbed soils. Excavated lodgement till sediments are suitable for reuse in structural fill applications if specifically allowed by project specifications, and if moisture conditions are adjusted to allow compaction to a firm and unyielding condition at the time of construction. If the moisture content of these sediments is elevated at the time of construction, moisture conditioning of the till could be achieved by spreading out the soil proposed for use as structural fill and aerating it during favorable dry site and weather conditions.

Vashon Ice Contact Sediments

Sediments encountered below the weathered till horizon in boring EB-12, approximately 2 feet below the ground surface, generally consisted of stiff to very stiff, fine sandy silt with trace to some gravel. We interpret these sediments to be representative of material deposited by meltwater in close proximity to the glacial ice during Vashon time. At the location of boring EB-12, the ice contact sediments extended to a depth of approximately 14.5 feet. With proper preparation, the ice contact deposits are suitable for support of foundations, floor slabs, and paving. Because of the fine-grained, non-granular texture, these sediments are highly moisture-sensitive and subject to disturbance when wet. Suitable compaction of fine-grained deposits is only achievable over a narrow range of moisture contents. Moisture conditioning of these sediments is difficult due to their cohesive, non-granular texture. For these reasons, we do not recommend the use of these sediments as structural fill. Because the ice contact sediments were only encountered in boring EB-12, their distribution at the site appears to be very limited.

Olympia Non-Glacial Sediments

Sediments encountered at a depth of approximately 28 feet (below the Vashon lodgement till) in boring EB-11, generally consisted of very dense, tan-gray, fine to medium sand with moderate to high silt content. Below a depth of approximately 33.5 feet, the sediments of this geologic unit consisted of hard, tan silt with trace gravel. The silt was generally massive but contained scattered, thin, sandy lenses. Although we observed no clear, distinguishing features characteristic of a particular geologic unit, their color, gradation, and stratigraphic position below the lodgement till suggest that these sediments may be representative of material deposited during the Olympia non-glacial period. The Olympia non-glacial period occurred prior to the Fraser Glaciation, approximately 30,000 to 60,000 years ago. At the location of exploration boring EB-11, these sediments extended to a depth of approximately 48 feet. Because these sediments lie below the maximum anticipated excavation depth for the project, use of these sediments for foundation support or as structural fill is not expected.

Possession Drift

Sediments encountered below the Vashon lodgement till in boring EB-8 generally consisted of very stiff to hard, blue-gray silt. The silt was generally massive to laminated and contained scattered fine sand partings. These sediments effervesced in hydrochloric acid. We interpret these sediments to be representative of Possession Drift. The Possession Drift was deposited in a glaciomarine environment during the Possession Glaciation, approximately 60,000 to 80,000 years ago. At the location of boring EB-8, the Possession Drift extended beyond the maximum depth explored of approximately 26.5 feet. Because these sediments lie below the maximum anticipated excavation depth in the area of boring EB-8, use of these sediments for foundation support or as structural fill is not expected.

Pre-Fraser Till

Sediments encountered below a depth of approximately 48 feet in boring EB-11 generally consisted of very dense, non-stratified, very silty, gravelly sand. Although these sediments appeared texturally similar to the Vashon lodgement till, their stratigraphic position below the suspected Olympia-aged non-glacial sediments indicate that they were deposited during a glacial period prior to the Fraser Glaciation. At the location of boring EB-11, the pre-Fraser till extended to a depth of approximately 68 feet. Because these sediments lie below the maximum anticipated excavation depth for the project, use of these sediments for foundation support or as structural fill is not expected.

Pre-Fraser Silt

Sediments encountered below the pre-Fraser till in boring EB-11 (below a depth of approximately 68 feet) generally consisted of hard silt with lenses and interbeds of very silty, fine sand. Based on their stratigraphic position below the pre-Fraser silt, deposition of these sediments also occurred prior to the Fraser Glaciation. These sediments were non-reactive in hydrochloric acid. At the location of boring EB-11, the pre-Fraser silt extended to a depth of approximately 80 feet. Because these sediments lie below the maximum anticipated excavation depth for the project, use of these sediments for foundation support or as structural fill is not expected.

Blakely Harbor Formation

Sediments encountered below the surficial topsoil horizon in exploration pits EP-4, EP-39, and EP-40 generally consisted of loose to very dense, brown to yellowish tan, sand with variable silt and gravel content. At the location of exploration pit EP-4, portions of the sediments consisted of soft to medium stiff, yellowish tan silt. The gravel-sized fraction of these sediments typically consisted of angular sedimentary rock. Similar sediments were encountered either directly below the surficial topsoil horizon, or below the lodgement till or pre-Fraser sediments in exploration borings EB-3 through EB-6, and EB-10 through EB-12. We interpret these sediments to be representative of the Blakely Harbor Formation. The Blakely Harbor Formation consists of a Miocene-aged sedimentary rock composed of sandstone, siltstone, conglomerate, tuff, and volcaniclastic sandstone. It is known to contain interbeds of coal, and in some locations, nearly coherent logs. Where encountered in our explorations, the bedrock was typically weathered and poorly lithified and exhibited physical characteristics more consistent with a non-lithified sediment than well indurated bedrock. However, the density/lithification of these sediments typically increased with depth. Sedimentary rock is also noted on the exploration logs for Terra pits TP-4 through TP-6 and TP-8. At these locations, the bedrock was encountered at depths ranging from approximately 2.5 to 9 feet.

Exploration pit EP-40 met with refusal in the bedrock at a depth of approximately 3 feet. Exploration borings EB-4 through EB-6, EB-10, and EB-12 met with refusal in the bedrock at depths ranging from approximately 12 to 20 feet. In our opinion, the bedrock will typically be rippable with conventional excavation equipment to the penetration depths achievable by the hollow-stem auger drilling rig used for our exploration. Refusal depths and elevations for these exploration locations are summarized below in Table 2. It should be noted that the refusal elevations shown in Table 2 were estimated from the LIDAR-based topography shown on Figure 2. The elevations shown in Table 2 should be considered accurate to the degree implied by the methods used to estimate them.

Exploration borings EB-4, EB-5, and EB-6 are located within the footprint of the proposed high school building. Although the estimated drilling refusal elevations all lie below the finished floor elevation of 510 feet, the density/lithification of the rock varies with both depth and location. We recommend that the contractor be prepared to use specialized rock-breaking equipment in the event that excavation in the bedrock cannot be achieved using conventional excavation equipment.

Table 2
Summary of Drilling/Excavation Refusal Depths in the Blakely Harbor Formation Bedrock

Boring #	Depth to Drilling/Excavation Refusal (feet)	Apx. Refusal Elevation (feet)
EB-4	20	494
EB-5	14	506
EB-6	12	508
EB-10	20	445
EB-12	18	487
EP-40	3	517

With proper preparation, the bedrock is suitable for support of foundations, floor slabs, and paving. Because of its elevated silt content, the weathered bedrock is moisture-sensitive and subject to disturbance when wet. The granular portions of the bedrock are suitable for reuse in structural fill applications if specifically allowed by project specifications, and if moisture conditions are adjusted to allow compaction to a firm and unyielding condition at the time of construction. Portions of the weathered bedrock composed predominantly of silt and clay are not recommended for use as structural fill.

4.2 Geologic Map Review

Review of the regional geologic map titled *Geologic Map of the Issaquah 7.5' Quadrangle, King County, Washington*, by Booth and Minard (1992) indicates that the area of the site is underlain by Vashon lodgement till with Tertiary sedimentary rock mapped in portions of the southern and eastern parts of the site. Our interpretation of the sediments encountered in our explorations is consistent with the regional geologic map.

4.3 Hydrology

Slow to moderately rapid groundwater seepage was observed in 12 of the AESI exploration pits. Seepage was also noted on three of the ESNW pits. Specifically, groundwater seepage was encountered in AESI exploration pits EP-4, EP-6, EP-10, EP-11, EP-13 through EP-15, EP-18, EP-19, EP-31, and EP-36 in ESNW pits TP-1, TP-3, and TP-4. Generally, the seepage was limited to a thin perched zone in the lower portion of the weathered till horizon within 4 feet of the ground surface. Similarly, shallow, perched seepage was encountered on the surface of the bedrock in exploration pit EP-4. This perched seepage, known as “interflow” occurs when stormwater infiltrates through the relatively permeable, weathered soil horizon and becomes perched atop the underlying, dense, low permeability, unweathered till or bedrock. The exceptions were exploration pits EP-6, EP-11, and EP-36. In exploration pits EP-6 and EP-36, a zone of thin, perched seepage was encountered in the unweathered till at depths of approximately 7 feet and 10 feet, respectively. The seepage encountered in exploration pit EP-11 was limited to a zone of thin, perched seepage within the existing fill at a depth of approximately 2 feet. The occurrence or level of seepage below the site likely varies in response to changes in season, precipitation, and other factors.

II. GEOLOGIC HAZARDS AND MITIGATIONS

The following discussion of potential geologic hazards is based on the geologic conditions as observed and discussed herein.

5.0 LANDSLIDE HAZARDS AND RECOMMENDED MITIGATION

Slope inclinations on the site generally range from approximately 30 percent or less but steepen to a maximum of approximately 50 percent in several areas. Those portions of the site with slope inclinations in excess of 40 percent are shown on Figure 4. With the exception of an area located near the southeast property corner, those areas with slope inclinations exceeding 40 percent are less than 15 feet in maximum height. The steep (greater than 40 percent) slope located near the southeast property corner has a maximum height of approximately 35 feet. With the exception of several small, isolated steep slope areas located in the southwestern portion of the site above 224th Lane SE and in the eastern portion of the site upslope of 228th Avenue SE, all of the steep slopes on the subject property are interpreted to have been created by previous grading associated with road, driveway, and parking lot construction, or the recent building demolition. Based on the morphology of the topography in the area of the taller (greater than 20-foot-high) steep slope area located near the southeast property corner, we interpret this steep slope to be a cut slope made for the construction of 228th Avenue SE and the south entrance road into the property.

Section 18.10.390 of the *Issaquah Municipal Code* (IMC) defines Landslide Hazard Areas as follows:

A. Slopes greater than 40 percent.

B. Any area with a combination of:

1. Slopes greater than 15 percent;
2. Impermeable soils (typically silt and clay) frequently interbedded with granular soils (predominantly sand and gravel); and,
3. Springs or groundwater seepage.

C. Any area which has shown movement during the Holocene epoch or is underlain by mass wastage debris of that epoch.

D. Any area potentially unstable as a result of rapid stream incision, stream bank erosion, or undercutting by wave action.

E. Any area showing evidence of, or at risk from snow avalanches.

F. Any area located on an alluvial fan, presently or potentially subject to inundation by debris flows or deposition of stream-transported sediments.

This section of the IMC defines Steep Slope Hazard Areas as any ground that rises at an inclination of 40 percent or more within a vertical elevation change of at least 10 feet. Those portions of the site with slope inclinations greater than 40 percent classify as Landslide Hazard Areas under the IMC. Those areas of the site with slope inclinations of 40 percent or more over a slope height of at least 10 feet classify as Steep Slope Hazard Areas.

Section 18.10.560 of the IMC states that a Landslide Hazard Area consisting of a slope of 40 percent or more shall only be altered as allowed under the Steep Slope Hazard Area development standards. The Steep Slope Hazard Area development standards, which are included in Section 18.10.580 of the IMC, state that a buffer shall be established at a horizontal distance of 50 feet from the top, toe, and sides of Steep Slope Hazard Areas with an additional 15-foot building setback established from the edge of the buffer. The buffer may be reduced to a minimum of 10 feet upon acceptance by the City of a geotechnical study supporting the buffer reduction. Alteration of steep slopes is generally prohibited under the code with limited alterations allowed for trails, utilities, and surface water conveyance. Section 18.10580E of the IMC states that an exemption from the prohibition of steep slope alteration may be granted by the City under the following conditions:

1. Where the height of a steep slope is 20 feet or less.
2. Where the slope has been created from previous legal grading activities.

In both of these cases, approval for alteration of the steep slope may be granted upon review and acceptance by the City of a soils report prepared by a geologist or licensed geotechnical engineer demonstrating that no adverse impacts will result from the exemption and the protection mechanisms specified in the IMC for steep slope areas are met. Steep slope protection mechanisms specified in Section 18.10.580 of the IMC include a factor of safety of at least 1.5

Proposed grading for the project is shown on Figure 3. The steep slope areas shown on this figure are all engineered slopes that will be constructed as part of the proposed grading. The proposed grading will eliminate the majority of the existing Steep Slope/Landslide Hazard Areas on the site. With the exception of several small, isolated steep slope areas located in the southwestern portion of the site above 224th Lane SE and in the eastern portion of the site upslope of 228th Avenue SE, all of the steep slopes on the subject property are interpreted to have been created by previous grading associated with road, driveway, and parking lot construction, or the recent building demolition. The natural steep slopes proposed for modification are limited in height to approximately 5 feet or less. Because the Steep Slope/Landslide Hazard Areas proposed for modification were either created during previous grading or are less than 20 feet in height, they are eligible for exemption to the prohibition of Steep Slope/Landside Hazard Area alteration provided that the exemption will not result in adverse impacts.

Although the majority of the Steep Slope/Landslide Hazard Areas proposed for modification under the proposed plan will be completely eliminated by grading and/or replaced by engineered slopes, some existing steep slopes will remain in place. Areas of steep (greater than 40 percent) slopes that will remain in place after grading is completed are shown on Figure 5.

5.1 Slope Reconnaissance

We completed a reconnaissance of the steep slopes at the site at the time of our field exploration. During our reconnaissance of these areas, we did not observe any geomorphologic indications of historic landslide activity, such as tension cracks, landslide scarps, or hummocky topography. No emergent seepage or unusually deformed tree trunks indicative of historical or ongoing slope movement were observed.

5.2 LIDAR Mapping

LIDAR-based imagery is a remote sensing technology that can be used to generate a detailed expression of ground surface topography even in densely vegetated areas. For this reason, LIDAR-based topographic imagery can be helpful in distinguishing surface features (such as old landslide features) that may otherwise not be easily recognizable. A LIDAR-based shaded relief map of the subject site is included as Figure 6. We did not observe any indications of historic landslide activity during our review of the LIDAR-shaded relief map.

5.3 Slope Stability Analysis

An analysis of the global stability of the steep slopes in the southeastern portion of the site was conducted using the computer program SLOPE/W, version 7.23 by GeoSlope International. The program used the Morgenstern-Price method for evaluating a rotational failure. Input parameters for the analysis included slope geometry, geology, and soil strength parameters. The slope geometry used for our analysis was based on the topography depicted on the civil grading plan along section lines A-A’ and B-B’ (Figure 7). These sections were selected for our analysis because they extend through the steepest and highest Steep Slope/Landslide Hazard Area on the site. For this reason, and because subsurface conditions across the site are relatively uniform, these sections are considered to be representative of the worst-case condition with respect to slope stability. Section A-A' also extends through the portion of the steep slope to receive the greatest thickness of fill. Section B-B' extends through the largest planned cut slope above the steep slope. The depth of the proposed cut is slightly greater about 15 feet north of B-B', but the height of the steep slope below the cut is greater along Section B-B'. The following cases were analyzed for each of these two sections:

- Existing topographic conditions, static case.
- Existing topographic conditions, seismic case.
- Post-construction (post-grading) conditions, static case.
- Post-construction conditions, seismic case.

Subsurface exploration in this area indicates that the slope is underlain by bedrock with Vashon lodgement till overlying the bedrock in most areas. Because the shear strength of the bedrock is estimated to be equivalent to or stronger than the lodgement till, we conservatively assumed that the native sediments underlying the slope consist entirely of lodgement till.

Soil strength parameters used in our analysis were based on published values and laboratory direct shear testing of similar materials completed for previous AESI projects. Specifically, the 2019 Washington State Department of Transportation *Geotechnical Design Manual* (WSDOT Manual) states that typical internal friction (Phi) angles for Vashon lodgement till range from 40 to 45 degrees with cohesion values ranging from 100 to 1,000 pounds per square foot (psf). Direct shear testing of three remolded samples of lodgement till completed for another AESI project using a large box shear apparatus resulted in measured cohesion values ranging from approximately 300 to 1,100 psf. For our analysis, we conservatively selected an internal friction angle of 40 degrees and a cohesion value of 300 psf for the lodgement till.

The post-construction profile for Section A-A' includes structural fill behind the retaining wall located at the toe of the slope. The type of structural fill to be used in this area has not been determined at this time. We anticipate that it would likely consist of either reworked soil from the subject site (i.e., lodgement till), or imported sand and gravel. For our analysis, we assumed a friction angle for the structural fill of 32 degrees and a cohesion value of 50 psf. In our opinion, these assumed values are conservatively low; however, it should be recognized that this fill will be retained by the wall proposed at the toe of the cut slope in this area and the intent of the stability analysis was to assess the global stability of the slope, not the local stability of the retaining wall. In this regard, the strength parameters assumed for the fill behind the retaining wall are inconsequential to the results of the global slope stability analysis. The soil strength parameters used for our analysis are shown on the SLOPE/W profiles included in Appendix B.

For evaluation of slope stability under seismic conditions, a horizontal ground acceleration of 0.26g was used for our analysis. This value is equivalent to ½ of the peak horizontal ground acceleration based on a seismic event with a 2 percent probability of exceedance in 50 years in accordance with the 2015 *International Building Code* (IBC).

The stability of a slope can be expressed in terms of its factor of safety. The factor of safety of a slope is the ratio between the forces that resist sliding to the forces that drive sliding. For example, a factor of safety of 1.0 would indicate a slope where the driving forces and the resisting forces are exactly equal. Increasing factor of safety values greater than 1.0 indicate increased stability. Factors of safety below 1.0 indicate conditions where the driving forces exceed the resisting forces and landsliding is imminent.

Under static conditions, the minimum calculated factors of safety all exceeded the minimum value of 1.5 specified in the IMC. The IMC does not specify a minimum factor of safety for seismic conditions, but as a typical standard of practice, a factor of safety of 1.1 is generally considered to be a minimum acceptable value. The minimum factors of safety calculated for seismic conditions all exceeded a factor of safety of 1.5. The minimum calculated factors of safety are summarized below in Table 3. Copies of the results of the slope stability analysis are included in Appendix B.

Table 3
Summary of Minimum Calculated Factors of Safety

Section Line	Case	Minimum Factor of Safety
A-A’	Existing Static	2.43
A-A’	Existing Seismic	1.52
A-A’	Post-Construction Static	3.69
A-A’	Post-Construction Seismic	2.13
B-B’	Existing Static	2.64
B-B’	Existing Seismic	1.62
B-B’	Post-Construction Static	2.65
B-B’	Post-Construction Seismic	1.61

5.4 Landslide Hazard Mitigation

The Landslide Hazard Areas identified at the site are limited to those areas with slope inclinations exceeding 40 percent. Some of these areas exceed 10 feet in height and therefore classify as Steep Slope Hazard Areas under the IMC. The slope stability analyses completed for our study indicate that the minimum calculated factors of safety exceed the minimum acceptable value specified in the IMC. For the reasons previously noted, the slope sections addressed in our stability analysis are considered to be the most sensitive steep slope areas on the site. The Steep Slope/Landslide Hazard Areas that will remain in place subsequent to site grading are shown on Figure 4. These areas are all located at least 50 feet from the proposed building locations and will be located in areas outside of the proposed disturbance limits. In our opinion, the buffers/setbacks between these areas and the proposed improvements are suitable for mitigation of landslide risk.

Based on our observations and analyses, it is our opinion that the risk of damage to the proposed project by landsliding is low under both static and seismic conditions. This opinion assumes that construction practices for the project will be completed in accordance with the recommendations presented in this report. We recommend that stormwater discharge on or adjacent to the top of the steep slopes be avoided as it could increase the potential for accelerated erosion and negatively impact the stability of the slopes.

5.5 Exemption Request

We request that the City grant an exemption to the prohibition against alteration of Steep Slope/Landslide Hazard Areas for this project for the following reasons:

1. The steep slopes proposed for alteration are cut slopes that resulted from previous legal grading associated with construction of 228th Avenue SE and the entrance road into the subject property.

2. Our assessment indicates that the protection mechanisms specified in the IMC for Steep Slope Areas are met and no adverse impacts will result from the exemption.

The requested exemption applies to all Steep Slope/Landslide Hazard Areas proposed for modification for the project as identified on Figures 3 through 5.

6.0 SEISMIC HAZARDS AND RECOMMENDED MITIGATION

Earthquakes occur in the Puget Sound Lowland with great regularity. The vast majority of these events are small and are usually not felt by people. However, large earthquakes do occur as evidenced by the most recent 6.8-magnitude event on February 28, 2001, near Olympia Washington, the 1965 6.5-magnitude event, and the 1949 7.2-magnitude event. The 1949 earthquake appears to have been the largest in this area during recorded history. Evaluation of return rates indicates that an earthquake of the magnitude between 5.5 and 6.0 is likely within a given 20-year period.

Generally, there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture, 2) seismically induced landslides, 3) liquefaction, and

4) ground motion. The potential for each of these hazards to adversely impact the proposed project is discussed below.

6.1 Surficial Ground Rupture

The subject site is located near both the South Whidbey Island Fault Zone (SWIFZ), and the Seattle Fault Zone.

A 2005 study by the U.S. Geological Survey (USGS) (Sherrod et al., 2005, *Holocene Fault Scarps and Shallow Magnetic Anomalies Along the Southern Whidbey Island Fault Zone Near Woodinville, Washington*, Open-File Report 2005-1136, March 2005) reported that "strong" evidence of prehistoric earthquake activity has been observed along two fault strands thought to be part of the southeastward extension of the SWIFZ. The study suggests as many as nine earthquake events along the SWIFZ may have occurred within the last 16,400 years. The recognition of this fault splay is relatively new, and data pertaining to it are limited with the studies still ongoing. The recurrence interval of movement along this fault system is still unknown, although it is hypothesized to be in excess of 1,000 years.

Studies of the Seattle Fault Zone by the USGS (e.g., Johnson et al., 1994, *Origin and Evolution of the Seattle Fault and Seattle Basin*, *Washington*, Geology, v. 22, pp. 71-74; and Johnson et al., 1999, *Active Tectonics of the Seattle Fault and Central Puget Sound Washington - Implications for Earthquake Hazards*, Geological Society of America Bulletin, July 1999, v. 111, n. 7, pp. 1042-1053) have provided evidence of surficial ground rupture along a northern splay of the Seattle Fault. According to the USGS studies, the latest movement of this fault was about 1,100 years ago when about 20 feet of surficial displacement took place. This displacement can presently be seen in the form of raised, wave-cut beach terraces along Alki Point in West Seattle and Restoration Point at the south end of Bainbridge Island. The recurrence interval of movement along this fault system is still unknown, although it is hypothesized to be in excess of several thousand years.

Due to the suspected long recurrence intervals for both fault zones, the potential for surficial ground rupture is considered to be low during the expected life of the proposed structure.

6.2 Seismically Induced Landslides

It is our opinion that the potential risk of damage to the proposed structures by seismically induced landsliding is low. Landslide hazards were previously discussed in greater detail in the "Landslide Hazards and Recommended Mitigation" section of this report.

6.3 Liquefaction

Liquefaction is a process through which unconsolidated soil loses strength as a result of vibrations, such as those which occur during a seismic event. During normal conditions, the weight of the soil is supported by both grain-to-grain contacts and by the fluid pressure within the pore spaces of the soil below the water table. Extreme vibratory shaking can disrupt the grain-to-grain contact, increase the pore pressure, and result in a temporary decrease in soil shear strength. The soil is said to be liquefied when nearly all of the weight of the soil is supported by pore pressure alone. Liquefaction can result in deformation of the sediment and settlement of overlying structures. Areas most susceptible to liquefaction include those areas underlain by non-cohesive silt and sand with low relative densities, accompanied by a shallow water table.

In our opinion, the potential risk of damage to the proposed structures by liquefaction is low due to the high relative density of the underlying sediments and bedrock, and the lack of adverse groundwater conditions. The site does not classify as a Seismic Hazard Area under the IMC.

6.4 Ground Motion/Seismic Site Class (2015 *International Building Code*)

Structural design of the building should follow 2015 IBC standards. We recommend that the project be designed in accordance with Site Class "C" as defined in IBC Table 20.3-1 of *American Society of Civil Engineers* (ASCE) *7 – Minimum Design Loads for Buildings and Other Structures*.

7.0 EROSION HAZARDS AND MITIGATION

The site soils contain significant quantities of silt and fine sand and are considered to be sensitive to erosion and disturbance when wet. Review of the Natural Resource Conservation Service (NRCS) Web Soil Survey indicates that soil in the area of the subject site is mapped as "*Alderwood gravelly sandy loam, 8 to 15 percent slopes (AgC)*, *Alderwood gravelly sandy loam, 15 to 30 percent slopes (AgD)*," and "*Beausite gravelly sandy loam, 15 to 30 percent slopes.*" The Alderwood soils are derived from lodgement till and the Beausite soils are derived from till and sandstone. The mapped soil types are generally consistent with the soil conditions observed in our explorations. Portions of the site which exhibit slope inclinations in excess of 15 percent classify as Erosion Hazard Areas under the IMC. Section 18.10.520 of the IMC restricts clearing activities in Erosion Hazard Areas to between April 1st and November 1st and specifies general best management practices and other requirements for work in these areas.

Project plans should include implementation of temporary erosion controls in accordance with local standards of practice. Control methods should include use of perimeter silt fences, and straw mulch in exposed areas. Removal of existing vegetation should be limited to those areas that are required to construct the project, and new landscaping and vegetation with equivalent erosion mitigation potential should be established as soon as possible after grading is complete. During construction, surface water should be collected as close as possible to the source to minimize silt entrainment that could require treatment or detention prior to discharge. Timely implementation of permanent drainage control measures should also be a part of the project plans and will help reduce erosion and generation of silty surface water onsite.

III. DESIGN RECOMMENDATIONS

8.0 INTRODUCTION

Our exploration indicates that, from a geotechnical engineering standpoint, the proposed project is feasible provided the recommendations contained herein are properly followed. Conventional spread footing foundations may be used for building support. The depth to suitable foundation bearing soils encountered in the explorations located in the proposed building areas generally ranged from approximately 1 to 5 feet.

9.0 SITE PREPARATION

Site preparation of building and paving areas should include removal of all sod, trees, brush, debris, pavement, and any other deleterious materials. All existing fill beneath planned foundation areas should be removed. Any remaining foundation elements, buried utilities, or other structures should be removed from below planned foundation areas. Buried utilities should be abandoned in place or removed from below planned new paving. Any depressions below planned final grades caused by demolition activities should be backfilled with structural fill, as discussed under the “Structural Fill” section of this report.

Existing topsoil should be stripped from all structural areas. The actual observed in-place depth of forest duff and topsoil at the locations of the explorations ranged from approximately 6 inches to 2 feet. After stripping, remaining roots and stumps should be removed from structural areas. All soils disturbed by stripping and grubbing operations should be recompacted as described below for structural fill.

Once excavation to subgrade elevation is complete, the resulting surface should be recompacted to a firm and unyielding condition. Subgrades below pavement areas should be proof-rolled with a loaded dump truck or other suitable equipment. Any soft, loose, yielding areas or areas exposing excessively organic material should be excavated to expose suitable bearing soils. The subgrade should then be compacted to a firm and unyielding condition. Structural fill can then be placed to achieve desired grades, if needed.

9.1 Temporary Cut Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be assessed during construction. For estimating purposes, however, temporary, unsupported cut slopes can be planned at maximum inclinations of 1.5H:1V (Horizontal: Vertical) in unsaturated existing fill or loose to medium dense, weathered glacial sediments or weathered bedrock-derived soils. Temporary slopes of up to 1H:1V can be planned in the unsaturated, dense to very dense, unweathered glacial sediments or weathered bedrock.

The recommended temporary cut slope angles apply where groundwater seepage is not present at the faces of the slopes. If seepage is present where temporary excavation slopes are exposed, flatter slope angles may be recommended. Alternatively, temporary dewatering in the form of pumped sumps or other measures may be recommended. As is typical with earthwork operations, some sloughing and raveling may occur, and cut slopes may have to be adjusted in the field. In addition, WISHA/OSHA regulations should be followed at all times.

9.2 Site Disturbance

The on-site soils contain high percentages of fine-grained material, which makes them moisture-sensitive and subject to disturbance when wet. The contractor must use care during site preparation and excavation operations so that the underlying soils are not softened. If disturbance occurs, the softened soils should be removed and the area brought to grade with structural fill.

9.3 Winter Construction

The existing fill material, natural glacial sediments, and weathered bedrock generally contain high percentages of silt and are considered highly moisture-sensitive. Some of these materials may require drying during favorable dry weather conditions to allow their reuse in structural fill applications. Care should be taken to seal all earthwork areas during mass grading at the end of each workday by grading all surfaces to drain and sealing them with a smooth-drum roller. Stockpiled soils that will be reused in structural fill applications should be covered whenever precipitation is anticipated.

If winter construction is expected, crushed rock fill could be used to provide construction staging areas where exposed soil is present. The stripped subgrade should be observed by the geotechnical engineer, and should then be covered with a geotextile fabric, such as Mirafi 500X or equivalent. Once the fabric is placed, we recommend using a crushed rock fill layer at least 10 inches thick in areas where construction equipment will be used.

10.0 STRUCTURAL FILL

All references to structural fill in this report refer to subgrade preparation, fill type, placement, and compaction of materials, as discussed in this section. If a percentage of compaction is specified under another section of this report, the value given in that section should be used.

For backfill of buried utilities in the right-of-way, the backfill should be placed and compacted in accordance with the City of Issaquah codes and standards.

After stripping, planned excavation, and any required overexcavation has been performed to the satisfaction of the geotechnical engineer/engineering geologist, the surface of the exposed ground should be recompacted to a firm and unyielding condition. If the subgrade contains too much moisture, adequate recompaction may be difficult or impossible to achieve, and should probably not be attempted. In lieu of recompaction, the area to receive fill should be blanketed with washed rock or quarry spalls to act as a capillary break between the new fill and the wet subgrade. Where the exposed ground remains soft and further overexcavation is impractical, placement of an engineering stabilization fabric may be necessary to prevent contamination of the free-draining layer by silt migration from below.

After recompaction of the exposed ground is approved, or a free-draining rock course is laid, structural fill may be placed to attain desired grades. Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts, with each lift being compacted to 95 percent of ASTM D-1557. The top of the compacted fill should extend horizontally outward a minimum distance of 3 feet beyond the locations of the perimeter footings or roadway edges before sloping down at a maximum angle of 2H:1V. Extending the fill beyond the footing edge provides subgrade conditions consistent with anticipated footing pressure distribution.

The contractor should note that any proposed fill soils should be evaluated by AESI prior to their use in fills. This would require that we have a sample of the material at least 72 hours in advance to perform a Proctor test and determine its field compaction standard.

Soils in which the amount of fine-grained material (smaller than the No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture-sensitive. The sediments encountered in our explorations contain substantially more than 5 percent fine-grained material. The use of moisture-sensitive soil in structural fills should be limited to favorable dry weather and dry subgrade conditions. Construction equipment traversing the site when the soils are wet can cause considerable disturbance.

If fill is placed during wet weather or if proper compaction cannot be attained, a select, import material consisting of a clean, free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil, with the amount of fine-grained material limited to 5 percent by weight when measured on the minus No. 4 sieve fraction, and at least 25 percent retained on the No. 4 sieve.

Excavated existing fill is suitable for reuse in structural fill applications if such reuse is specifically allowed by project plans and specifications, if it is free of excessive organic debris and other deleterious materials, and the moisture content is at or adjusted to a level suitable to achieve the specified level of compaction. Portions of the sediments encountered in our explorations exhibited moisture contents above the optimum for achieving suitable compaction. These sediments are described as “very moist” on the exploration logs in Appendix A.

Excavated weathered bedrock can be reused as structural fill provided that it can be broken down into particle sizes less than 4 inches in diameter and placement occurs during dry weather and dry subgrade conditions. Because of its elevated silt content, the weathered bedrock is moisture-sensitive and subject to disturbance when wet. The granular portions of the bedrock are suitable for reuse in structural fill applications if specifically allowed by project specifications, and if moisture conditions are adjusted to allow compaction to a firm and unyielding condition at the time of construction.

Soil moisture conditions should be expected to vary with location, depth, weather conditions, season, and other factors. If the moisture content of the excavated on-site soils proposed for reuse in structural fill applications is high at the time of construction, they could be moisture-conditioned by drying during favorable dry weather conditions. Alternatives to drying site soils include treating the soil with Portland cement or using imported granular soils with moisture contents suitable for achieving the specified compaction.

10.1 Controlled Low-Strength Material

Controlled low-strength material, also known as controlled density fill or “CDF,” is normally specified in terms of its compressive strength, which typically ranges from approximately 50 to 200 pounds per square inch (psi). CDF having a strength of 50 psi (7,200 pounds per square foot [psf]), provides adequate support for most structural applications and can be readily excavated with hand shovels and other non-mechanized tools. A strength of 100 psi (14,400 psf) provides additional support for special applications, but greatly increases the difficulty of hand excavation. In general, CDF with a strength greater than about 100 psi requires power equipment to excavate and therefore should not be used in areas where future hand excavation may be needed. CDF may be used in lieu of structural fill for this project. However, in those areas where CDF will be used below footings with an allowable bearing pressure exceeding 3,000 psf, we recommend that the CDF have a minimum compressive strength of 200 psi.

11.0 FOUNDATIONS

Conventional continuous footings and column pads may be used for building support when founded either directly on the undisturbed, medium dense to very dense natural sediments, or on structural fill placed over these materials. We recommend that an allowable foundation soil bearing pressure of 3,000 psf be used for design purposes, including both dead and live loads. An allowable bearing pressure of 6,000 psf may be used where foundations bear directly on the dense to very dense, unweathered glacial sediments or bedrock. In most areas of the site, dense to very dense sediments/bedrock were encountered in our explorations at depths of approximately 1 to 5 feet. However, dense natural sediments were encountered at depths of up to approximately 10 to 15 feet in a few locations. An increase in the allowable bearing pressure of one-third may be used for short-term wind or seismic loading. If structural fill is placed below footing areas, the structural fill should extend horizontally beyond the footing edges. For a footing supported on a structural fill bearing pad, this distance should be equal to or greater than the thickness of the fill pad. This requirement does not apply to footings supported on a large mass fill such as behind a tall retaining wall.

All footings must penetrate to the prescribed bearing stratum and no footing should be founded in or above loose, organic, or existing fill soils. It should be noted that the area bounded by lines extending downward at 1H:1V from any footing must not intersect another footing or filled area. In addition, a 1.5H:1V line extending down from any footing must not daylight because sloughing or raveling may eventually undermine the footing. Thus, footings should not be placed near the edge of steps or cuts in the bearing soils.

We recommend using a modulus of subgrade reaction equal to 40 pounds per cubic inch (pci) for footings designed for an allowable bearing pressure of 3,000 psf and a modulus of subgrade reaction equal to 80 pci for footings designed for an allowable bearing pressure of 6,000 psf. Anticipated settlement of footings founded on suitable bearing soils should be less than 1 inch with differential settlement one-half of the anticipated total settlement. Most of this movement should occur during initial dead load applications. However, disturbed soil not removed from footing excavations prior to concrete placement could result in increased settlements. All footing areas should be observed by AESI prior to placing concrete to verify that the design bearing capacity of the soils has been attained and that construction conforms to the recommendations contained in this report. Such observation may be required by the City of Issaquah. Perimeter foundation drain systems should be provided as discussed under the "Drainage Considerations" section of this report.

The contractor must use care during site preparation and excavation operations so that the underlying soils are not softened. If disturbance occurs, the softened soils should be removed and foundations extended down to competent natural soil. Once the base of the excavation is reached, consideration should be given to "armoring" the exposed subgrade with a thin layer of imported aggregate to provide a working surface during foundation construction. We recommend a 6-inch layer of crushed rock for this purpose.

11.1 Drainage Considerations

All building and retaining wall foundations should be provided with foundation drains. Drains should consist of rigid, perforated, polyvinyl chloride (PVC) pipe surrounded by washed gravel. The drains should be constructed with sufficient gradient to allow gravity discharge away from the proposed building. Roof and surface runoff should not discharge into the footing drain system, but should be handled by a separate, rigid, tightline drain. In planning, exterior grades adjacent to walls should be sloped downward away from the proposed structures to achieve surface drainage.

12.0 FLOOR SUPPORT

Slab-on-grade floors may be constructed either directly on the medium dense to dense, natural sediments, or on structural fill placed over these materials. Areas of the slab subgrade that are disturbed (loosened) during construction should be recompacted to an unyielding condition prior to placing the capillary break, as described below. Slab-on-grade floors should be constructed atop a capillary break consisting of a minimum thickness of 4 inches of washed pea gravel or washed, crushed rock. The washed pea gravel or crushed rock should be overlain by a 10-mil (minimum thickness) plastic vapor retarder.

13.0 FOUNDATION WALLS

The following recommendations may be applied to backfilled concrete retaining walls. We should be allowed to offer situation-specific input for taller walls. All backfill behind foundation walls or around foundation units should be placed as per our recommendations for structural fill and as described in this section of the report. Horizontally backfilled walls, which are free to yield laterally at least 0.1 percent of their height, may be designed to resist lateral earth pressure represented by an equivalent fluid equal to 35 pounds per cubic foot (pcf). Fully restrained, horizontally backfilled, rigid walls that cannot yield should be designed for an equivalent fluid of 50 pcf. Walls with sloping backfill up to a maximum gradient of 2H:1V should be designed using an equivalent fluid of 55 pcf for yielding conditions or 75 pcf for fully restrained conditions. If parking areas are adjacent to walls, a surcharge equivalent to 2 feet of soil should be added to the wall height in determining lateral design forces.

As required by the 2015 IBC, retaining wall design should include a seismic surcharge pressure in addition to the equivalent fluid pressures presented above. Considering the site soils and the recommended wall backfill materials, we recommend a seismic surcharge pressure of 9H and 11H psf, where H is the wall height in feet for the "active" and "at-rest" loading conditions, respectively. The seismic surcharge should be modeled as a rectangular distribution with the resultant applied at the midpoint of the walls.

The lateral pressures presented above are based on the conditions of a uniform backfill consisting of excavated on-site soils, or imported structural fill compacted to 90 to 95 percent of ASTM D-1557. A higher degree of compaction is not recommended, as this will increase the pressure acting on the walls. A lower compaction may result in settlement of the slab-on-grade or other structures supported above the walls. Thus, the compaction level is critical and must be tested by our firm during placement. Surcharges from adjacent footings or heavy construction equipment must be added to the above values. Perimeter footing drains should be provided for all retaining walls, as discussed under the "Drainage Considerations" section of this report.

It is imperative that proper drainage be provided so that hydrostatic pressures do not develop against the walls. This would involve installation of a minimum 1-foot-wide blanket drain to within 1 foot of finish grade for the full wall height using imported, washed gravel against the walls.

13.1 Passive Resistance and Friction Factors

Lateral loads can be resisted by friction between the foundation and the natural soils or supporting structural fill soils, and by passive earth pressure acting on the buried portions of the foundations. The foundations must be backfilled with structural fill and compacted to at least 95 percent of the maximum dry density to achieve the passive resistance provided below. We recommend the following allowable design parameters:

- Passive equivalent fluid = 300 pcf
- Coefficient of friction = 0.35

14.0 PAVEMENT RECOMMENDATIONS

14.1 Flexible Pavement

The project will include construction of new asphalt-paved surfaces in the form of parking lots, access drives, and bus loops. Pavement recommendations for these areas are provided below. The project will also include widening and other improvements in 228th Avenue SE. Pavement design for the 228th Avenue SE improvements is being assessed and pavement recommendations for this area will be provided in a separate report.

After the area to be paved is stripped, any organic soils are removed, and the soils are recompacted, the area should be proof-rolled with a loaded dump truck under the observation of AESI. Any soft, wet, organic, or yielding areas should be mitigated as recommended during construction. If warranted, engineering stabilization fabric, such as Mirafi 500X (or equivalent), should be placed over the subgrade with the edges overlapped in accordance with the manufacturer's recommendations. Following subgrade preparation, clean, free-draining structural fill should be placed over the fabric and compacted to 95 percent of ASTM D-1557. Where fabric is exposed, spreading should be performed such that the dozer remains on the fill material and is not allowed to operate directly on the uncovered fabric. When 12 inches of fill has been placed, the fill should be proof-rolled with a loaded dump truck to pretension the fabric and identify soft spots in the fill. Upon completing the proof-rolling operation, additional structural fill should be placed and compacted to attain desired grades.

For driveways and paving serving passenger cars, we recommend a paving section consisting of 3 inches of Class ½-inch Hot Mix Asphalt (HMA) underlain by 4 inches of crushed surfacing base course (CSBC). Alternatively, asphalt treated base (ATB) or Class ¾-inch HMA could be used for construction access followed by repair of any construction damage and final surfacing. If this alternative is used, we recommend a minimum of 2 inches of CSBC to serve as a working surface and a minimum of 3 inches of ATB. Final surfacing should consist of 2 inches of Class ½-inch HMA after any construction damage has been repaired.

Paving for heavy traffic areas such as bus lanes, fire lanes, and access for garbage and food service trucks should consist of 4 inches of Class ½-inch HMA above 6 inches of crushed rock base. If an ATB section is desired, we recommend a 2-inch-thick working surface of crushed rock, topped by 4 inches of ATB and 3 inches of Class ½-inch HMA.

14.2 Rigid Pavement

Project plans include the use of rigid concrete pavement at loading docks, in the fire lane east of the high school, and in the student drop-off area in front of the high school. Upon completion of the subgrade preparation as described above for flexible pavement, we recommend the following rigid pavement sections:

- Student Drop-Off Area

  6 inches - Portland Cement Concrete (PCC)
  4 inches - Compacted, 1¼-inch minus crushed surfacing base course

- Loading Dock and Fire Lane Areas

  7 inches - Portland Cement Concrete (PCC)
  4 inches - Compacted, 1¼-inch minus crushed surfacing base course

The base course material should be compacted to 95 percent of maximum dry density as defined by ASTM D-1557.

All concrete should have a minimum of six sacks of cement per cubic yard, a minimum 28-day compressive strength of 4,000 psi, and a minimum 28-day flexural strength of 650 psi. We further recommend that all concrete contain 5 percent entrained air for freeze-thaw protection and be placed at a maximum 2½-inch slump. The wear surface should be textured with a coarse metal broom or rake finish to provide skid resistance.

To allow for an orderly arrangement of the cracking that concrete naturally undergoes during curing, we recommend placement of contraction joints. The depth of the joints should be sawed into the hardened concrete, formed by plastic strips, or tooled into the concrete during placement. Contraction joints should be placed at a maximum of 15-foot intervals. If rigid pavement is to be used for covering broad expanses, contraction joints should be placed on a 15-foot grid pattern.

Expansion joints should be installed at 60-foot intervals along the fire lane. These joints will also function as contraction joints. The expansion joints should be ¾ inch wide. All expansion joints should be filled with suitable filler material.

Load transfer dowels should be installed perpendicular to all pavement expansion joints. These dowels should be ¾-inch-diameter (No. 6), smooth bars, 18 inches in length, thus allowing 9 inches of penetration on each side of the joint. Load transfer dowels should be spaced 12 inches on-center and be set 3 inches below the concrete surface. Suitable wire mesh reinforcement, properly placed (and properly maintained during construction) in the upper one-third of the slab, should also be provided for all concrete pavements.

15.0 ATHLETIC FIELD DESIGN AND CONSTRUCTION

We understand that the new athletic field for the high school will have a synthetic turf surface and lighting.

AESI has participated in construction of numerous synthetic turf athletic fields in western Washington. In our opinion, synthetic turf projects are very specialized, and should be designed by a specialty field designer with demonstrated experience designing and construction managing synthetic turf athletic fields in Western Washington. The recommendations presented below include geotechnical recommendations directed to the field designer. We are available on request to assist the field designer as plans are formulated.

15.1 Athletic Field Site Preparation

We recommend that the surface of the subgrade soils exposed during grading be compacted with a smooth-drum, vibratory roller to at least 90 percent of the modified Proctor maximum dry density, as determined by the ASTM D-1557 test procedure, and to a firm and unyielding surface. When stripping and excavation are completed, we anticipate that exposed soils will consist of existing fill or lodgement till. If areas of existing fill with excessive organic material or demolition waste are exposed after rough grading, it may be appropriate to overexcavate these materials and replace them with suitable fill. We recommend that project bid documents include some overexcavation and replacement of subgrade soils in the base bid, and equitable unit costs for volumes more or less than the base bid. A base bid volume of overexcavation and replacement of 200 cubic yards might be appropriate based on subsurface exploration data. We recommend that volumes of overexcavation and replacement be defined in terms of bank cubic yards, with unit costs volumes based on before and after survey data. The District should be aware that the 200-cubic-yard figure is an estimate and is used to establish an equitable base bid and unit cost structure that is flexible and able to address field conditions that will not be fully known until the time of construction. We recommend that the District carry a budget contingency for additional overexcavation and replacement beyond what is included in the base bid.

Following stripping, any organic material removal, replacement, and recompaction, all athletic field and track subgrades should be proof-rolled using a loaded dump truck or other suitable equipment under the observation of the geotechnical engineer. If soft or yielding areas are observed during proof-rolling, additional preparation might be required. Depending upon field conditions at the time of construction, additional preparation could include overexcavation and replacement of yielding soils with structural fill, use of a geotextile fabric, soil cement admixture stabilization, or some combinations of these methods. The amount of overexcavation will depend on the time of year construction occurs, the amount of precipitation during this time, and the amount of care the contractor takes in protecting the exposed subgrade.

The on-site soils contain a significant amount of fine-grained material, which makes them moderately moisture-sensitive and subject to disturbance when wet. The contractor must use care during site preparation and excavation operations so that the underlying soils are not softened. If disturbance occurs, the softened soils should be removed and the area brought to grade with structural fill. It should be noted that the moisture content of the site soils was visually estimated to typically be near or above the optimum moisture content for compaction purposes at the time of our study. It will likely be necessary to aerate site soils during favorable dry weather to reach suitable moisture contents prior to compaction.

15.2 Athletic Field Cut and Fill Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction. For estimating purposes, however, we anticipate that temporary, unsupported cut slopes in the existing fill can be made at a maximum slope of 1.5H:1V or flatter. Temporary slopes in unsaturated lodgement till may be planned at 1H:1V. As is typical with earthwork operations, some sloughing and raveling may occur, and cut slopes may have to be adjusted in the field. If groundwater seepage is encountered in cut slopes, or if surface water is not routed away from temporary cut slope faces, flatter slopes will be required. In addition, WISHA/OSHA regulations should be followed at all times. Permanent cut and structural fill slopes that are not intended to be exposed to surface water should be designed at inclinations of 2H:1V or flatter. All permanent cut or fill slopes should be compacted to at least 95 percent of the modified Proctor maximum dry density, as determined by ASTM D-1557, and the slopes should be protected from erosion by sheet plastic until vegetation cover can be established during favorable weather.

15.3 Athletic Field Structural Fill

Fill Placement

After athletic field stripping, excavation, and any required overexcavation have been performed to the satisfaction of the geotechnical engineer/engineering geologist, the upper 12 inches of exposed ground should be recompacted to 90 percent of the modified Proctor maximum density using ASTM D-1557 as the standard. If the subgrade contains too much moisture, adequate recompaction may be difficult or impossible to obtain and should probably not be attempted. In lieu of recompaction, the area to receive fill should be blanketed with washed rock or quarry spalls to act as a capillary break between the new fill and the wet subgrade. Where the exposed ground remains soft and further overexcavation is impractical, placement of an engineering stabilization fabric may be necessary to prevent contamination of the free-draining layer by silt migration from below.

After recompaction of the exposed ground is tested and approved, or a free-draining rock course is laid, structural fill may be placed to attain desired grades. Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts, with each lift being compacted to 90 percent of the modified Proctor maximum density using ASTM D-1557 as the standard. In the case of utility trench filling, the backfill may also need to be placed and compacted in accordance with current local codes and standards. The top of the compacted fill should extend horizontally outward a minimum distance of 3 feet beyond the locations of athletic field and pavement edges before sloping down at a maximum angle of 2H:1V.

The contractor should note that any proposed fill soils must be evaluated by AESI prior to their use in fills. This would require that we have a sample of the material 72 hours in advance of filling activities to perform a Proctor test and determine its field compaction standard. Soils in which the amount of fine-grained material (smaller than the No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture-sensitive. Use of moisture-sensitive soil in structural fills should be limited to favorable dry weather conditions. The on-site existing fill and native sediments contain significant amounts of silt and are considered highly moisture-sensitive. We anticipate that most of the existing soils will be wetter than optimum moisture content for compaction purposes and will require drying during favorable dry site and weather conditions prior to reuse in structural fill applications. The reuse of on-site soils in structural fill applications is contingent on moisture-conditioning to a moisture content that allows compaction to a firm and unyielding condition at the specified level and is only permitted if specifically allowed by project plans and specifications.

Construction equipment traversing the site when the soils are wet can cause considerable disturbance. If fill is placed during wet weather or if proper compaction cannot be obtained, a select import material consisting of a clean, free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil with the amount of fine-grained material limited to 5 percent by weight when measured on the minus No. 4 sieve fraction with at least 25 percent retained on the No. 4 sieve.

15.4 Subsurface Drains (Underdrains)

We recommend that a subsurface drainage system be provided below the new field. The new underdrain system should consist of perforated pipes placed approximately 15 to 20 feet apart. The pipes should have an invert of at least 12 inches below final grade and be enveloped in washed pea gravel which freely communicates with the field surfacing. We defer to the field designer for specific underdrain requirements and are available to provide geotechnical recommendations related to underdrain design on request.

Subsurface Drain Trenching

Based on current grading plans, field elevation will be approximately elevation 509 feet. To achieve the planned field elevation fills ranging from 3 to 8 feet or cuts of about 2 feet will be required. Construction of the subsurface drains will require trenching into the new fill or lodgement till. The new fill soils within the proposed athletic field area will be medium dense to dense while the lodgement till will be medium dense to very dense. The lodgement till could contain gravel, cobbles and boulders. Therefore, the contractor should be prepared to excavate dense soils and to encounter gravel, cobbles, and occasional boulders during trenching.

15.5 Subfield Drainage Aggregate

We anticipate that two layers of drainage aggregate will be placed and compacted over the prepared field subgrade and below the turf. The drainage aggregate is a very specialized manufactured product that provides a compactable, stable working surface while maintaining a high minimum infiltration rate. Ideally, the aggregate should be sourced from a supplier who has demonstrated experience providing synthetic field drainage aggregate on previous projects. The drainage aggregate should be tested for gradation and approved by the field designer prior to delivery onsite. Daily sampling and gradation testing during placement is recommended. The material should be kept moist during transport, placement, and compaction to reduce the potential for fines segregation. Once placed and compacted, the material should be field tested for density and permeability. If field permeability test results are below the minimum project requirements, the material may need to be loosened and recompacted or removed and replaced with materials that meet the minimum permeability requirements.

15.6 Athletic Field Light Pole Foundations

We understand that light pole foundations for this project will consist of concrete piers cast neat against the sidewalls of drilled holes without the use of forms.

Compressive Capacities

For this project, we anticipate that lateral capacities will be the most critical design factor for the light pole foundations and will likely exert the most control over the depth of embedment. We recommend that the end-bearing portion of the axial compressive capacity be assumed to be 500 psf for light poles embedded at least 5 feet below the ground surface into new structural fill, existing fill or lodgement till. Vertical capacity can also be achieved through friction along the shafts of the poles, as described below.

Frictional Resistance

For frictional resistance along the shaft of the drilled piers used for light pole foundations, acting both in compression and in uplift, an allowable skin friction value of 250 psf for the existing fill, new structural fill or lodgement till is recommended. We recommend that frictional resistance be neglected in the uppermost 2 feet below the ground surface. The allowable skin friction value includes a safety factor of at least 2.0.

Lateral Capacities

Passive Pressure Method

Lateral loads on the proposed light pole foundations, caused by seismic or transient loading conditions, may be resisted by passive soil pressure against the side of the foundation. An allowable passive earth pressure of 200 pcf, expressed as an equivalent fluid unit weight, may be used for that portion of the foundation embedded within existing fill. The above values only apply to foundation elements cast “neat” against undisturbed soil. For new structural fill placed around the pier shaft or lodgement till, a passive earth pressure value of 250 pcf is recommended. All fill must be placed as structural fill and compacted to at least 95 percent of ASTM D-1557. Passive values presented may be represented by a triangular pressure distribution acting over two pier diameters beginning at the surface and held at a constant depth greater than 8 feet. The triangular pressure distribution is truncated above 2 feet.

Light Pole Foundation Construction Considerations

In our opinion, the light pole foundation excavations may need to be cased during drilling within fill soils to facilitate construction and limit caving. The contractor should include temporary casing for the light pole foundation holes in their base bid, in our opinion. The contractor should have the ability to excavate and remove obstacles encountered during light pole foundation drilling, or light pole locations should be shifted to avoid obstacles that are encountered.

16.0 INFILTRATION FEASIBILITY

Because of their high percentage of fine-grained material and high relative density, the lodgement till and Blakely Harbor Formation bedrock are not recommended receptor soils for stormwater infiltration. Exploration boring EB-11, located in the central portion of the site, was drilled to a maximum depth of approximately 86 feet to assess the feasibility of deep infiltration. With the exception of a thin sand stratum encountered in this boring at a depth of approximately 30 feet, the sediments encountered in boring EB-11 consisted of dense, silty deposits. Because of their high relative density/consistency and elevated silt content, these sediments exhibit a low permeability and are not considered suitable receptor soils for stormwater infiltration. The sand stratum encountered at a depth of approximately 30 feet in boring EB-11 was estimated to be about 4 feet thick. In addition, this stratum was not encountered in any of the other explorations advanced at the site. Because of its limited thickness and lateral extent, it is our opinion that this sand stratum is not a suitable receptor soil for stormwater infiltration. Due to the lack of suitable infiltration receptor soils at the site, on-site stormwater infiltration is not recommended for this project. Exploration boring EB-11 was terminated in the Blakely Harbor Formation bedrock.

17.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

Because project plans were not available at the time of our study, this report is considered to be preliminary. We recommend that we be allowed to review project plans when they are completed and to revise the recommendations presented in this report, if appropriate.

We are also available to provide geotechnical engineering and monitoring services during construction. The integrity of the foundation system depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent.

We have enjoyed working with you on this study and are confident these recommendations will aid in the successful completion of your project. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Kurt D. Merriman, P.E.
Digitally signed by Kurt D. Merriman, P.E.
Date: 2021.06.21 16:28:50 -07'00'

KURT D. MERRIMAN
23580

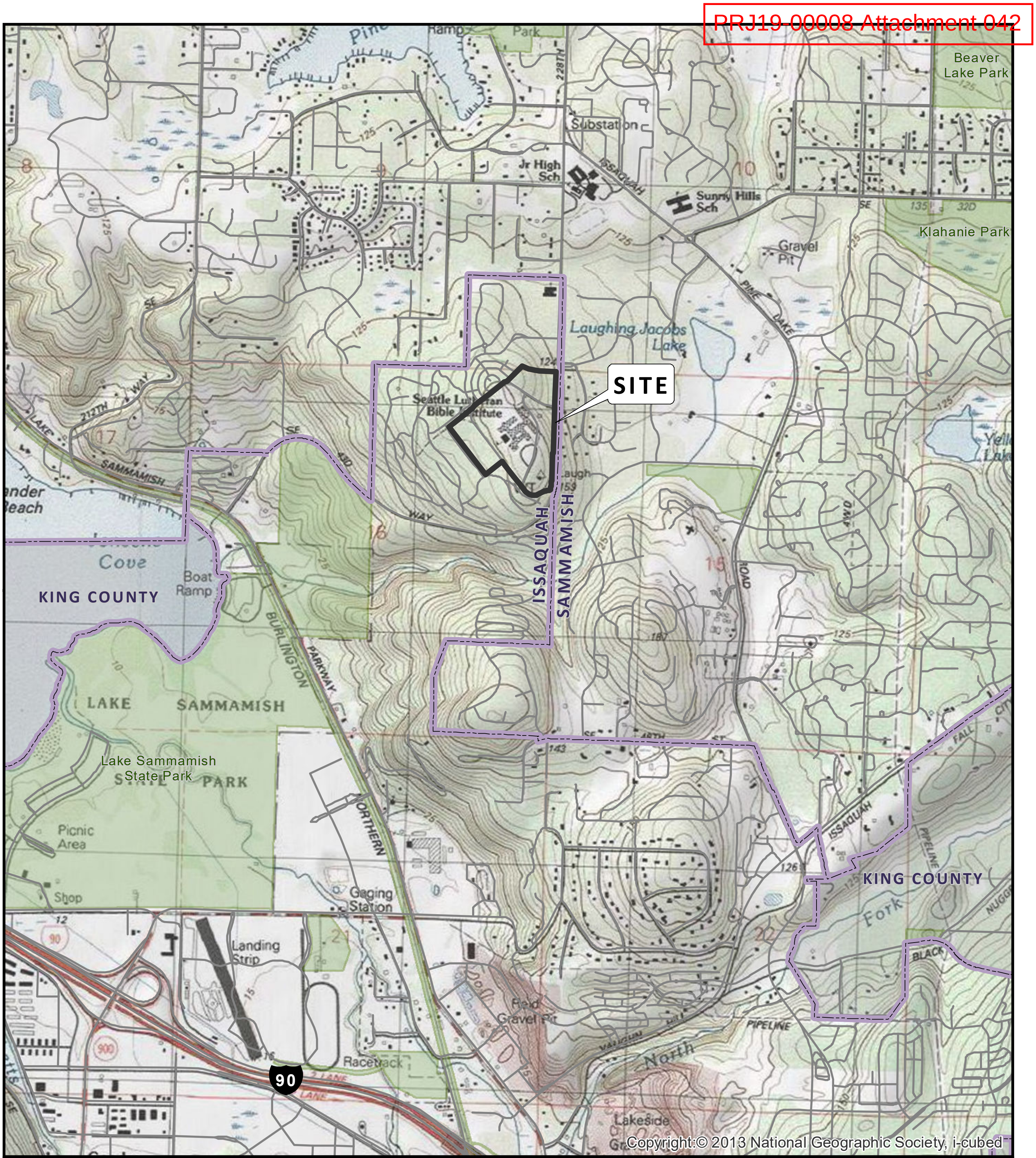
Timothy J. Peter, L.E.G., L.Hg.
Senior Engineering Geologist

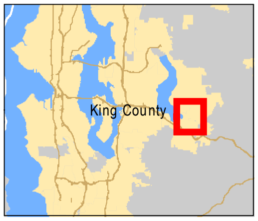
Stephen A. Siebert, P.E.
Associate Geotechnical Engineer

Kurt D. Merriman, P.E.
Senior Principal Engineer

Attachments:
Figure 1: Vicinity Map
Figure 2: 2017 Aerial, LIDAR Based Contours
Figure 3: Site and Exploration Plan
Figure 4: Existing Slopes Exhibit
Figure 5: Post-Construction Steep Slopes
Figure 6: LIDAR Shaded Relief Map
Figure 7: Steep Slope Section Locations
Appendix A: Exploration Logs
Appendix B: SLOPE/W Profiles

PRJ19-00008 Attachment 042





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0 1000 2000

FEET

DATA SOURCES / REFERENCES:
USGS: 7.5' SERIES TOPOGRAPHIC MAPS, ESRI/I-CUBED/NGS 2013
KING CO: STREETS, CITY LIMITS 1/18, PARCELS 8/18

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE

NOTE: BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

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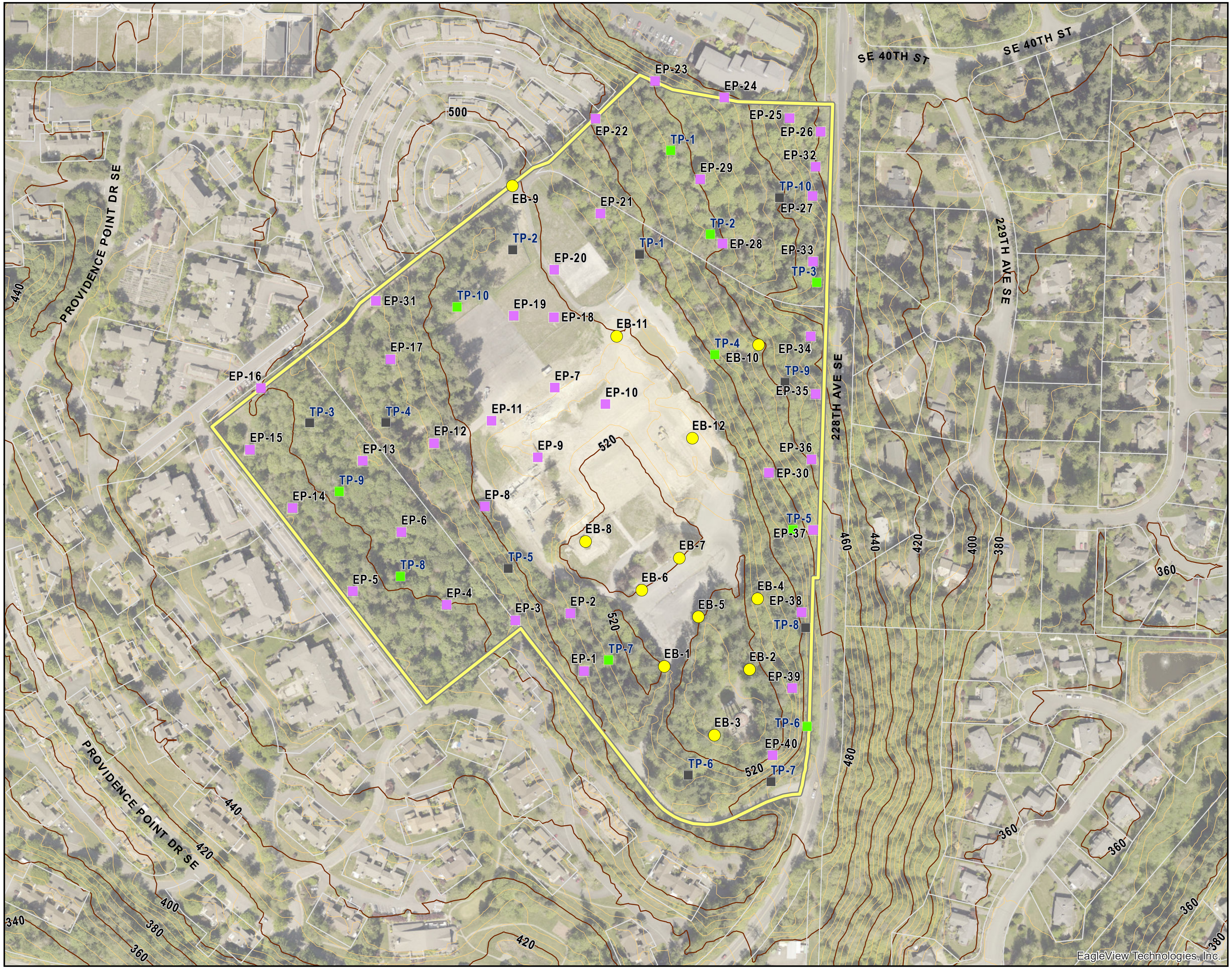
VICINITY MAP

ISSAQUAH HS #4 AND ES #17
ISSAQUAH, WASHINGTON

PROJ NO.	DATE:	FIGURE:
180070E001	9/19	1

Document Path: G:\GIS_Projects\aaY2018\180070 Issaquah HS\mxd\180070E001 F1 VM_IssaquahHS.mxd

PRJ19-00008 Attachment 042



▭ SITE

● EXPLORATION BORING

■ EXPLORATION PIT

■ TEST PIT BY BY EARTH SOLUTIONS NW (2014)

🟩 TEST PIT BY TERRA ASSOCIATES INC. (2015)

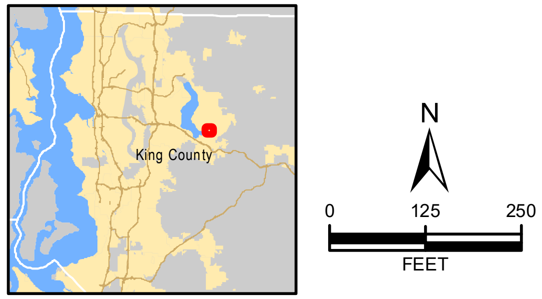
▭ PARCEL

〰 CONTOUR 20 FT

〰 CONTOUR 5 FT

DATA SOURCES / REFERENCES:
PSLC: KING COUNTY 2016, GRID CELL SIZE IS 3'.
DELIVERY 3 FLOWN 3/2/16 - 3/29/16.
CONTOURS / SLOPES FROM LIDAR
KING CO: STREETS, 1/19, PARCELS 4/19, AERIAL PICTOMETRY INT. 2019
TEST PITS FROM: "GEOTECHNICAL REPORT MADISON POINTE",
BY TERRA ASSOCIATES 11/14/2018

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

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2019 AERIAL LIDAR BASED CONTOURS

ISSAQUAH HS #4 AND ES #17
ISSAQUAH, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20180070E001	6/21	2

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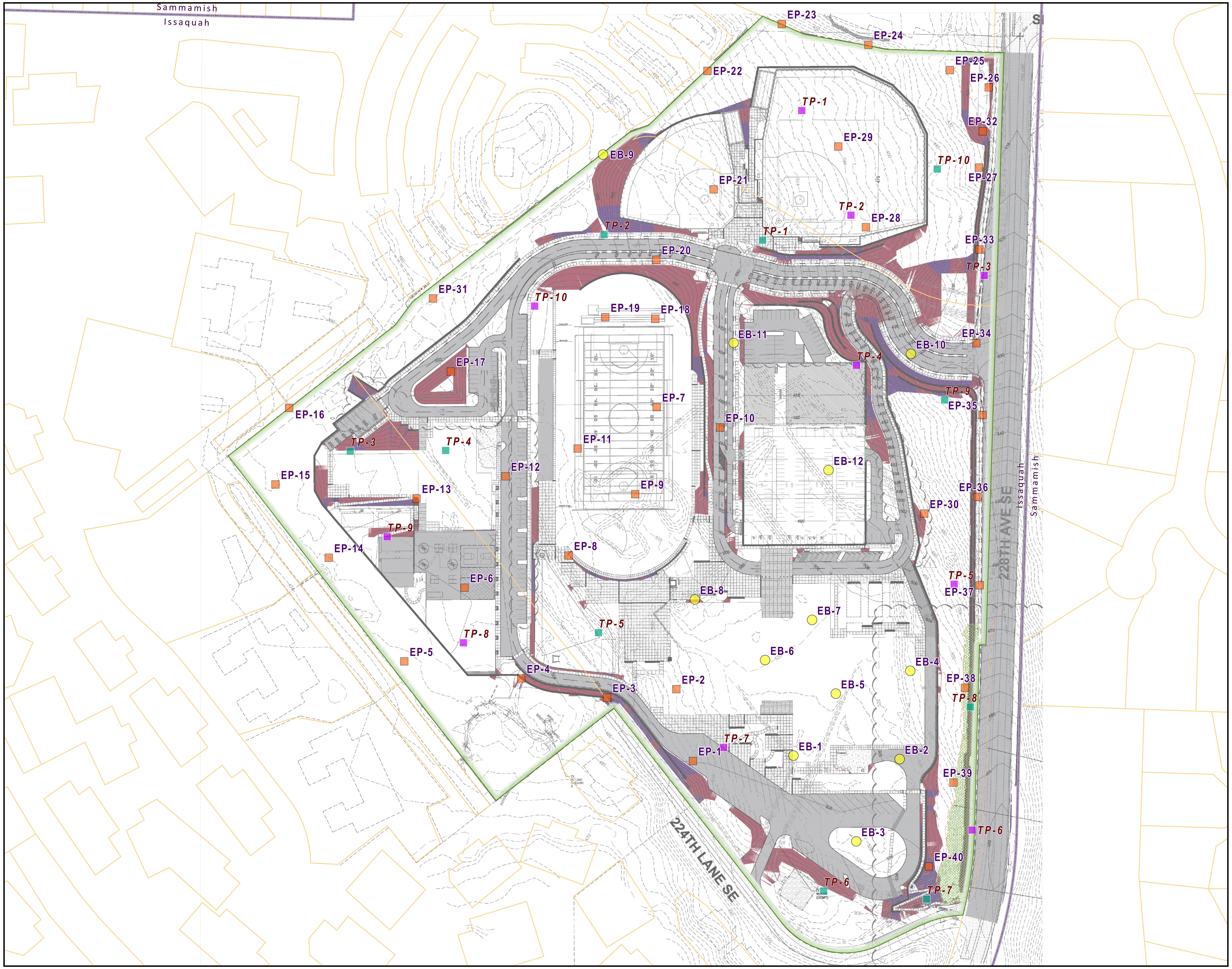


LEGEND

- 🟩 SITE
- ● EXPLORATION BORING
- 🟧 EXPLORATION PIT
- 🟩 TEST PIT BY EARTH SOLUTIONS NW
- 🟪 TEST PIT BY TERRA ASSOCIATES
- ▭ CITY BOUNDARY
- ▭ PARCEL

Slopes Table

Number	Maximum Slope	Color
1	15-40% SLOPES	🟥
2	GREATER THAN 40% SLOPES	🟪

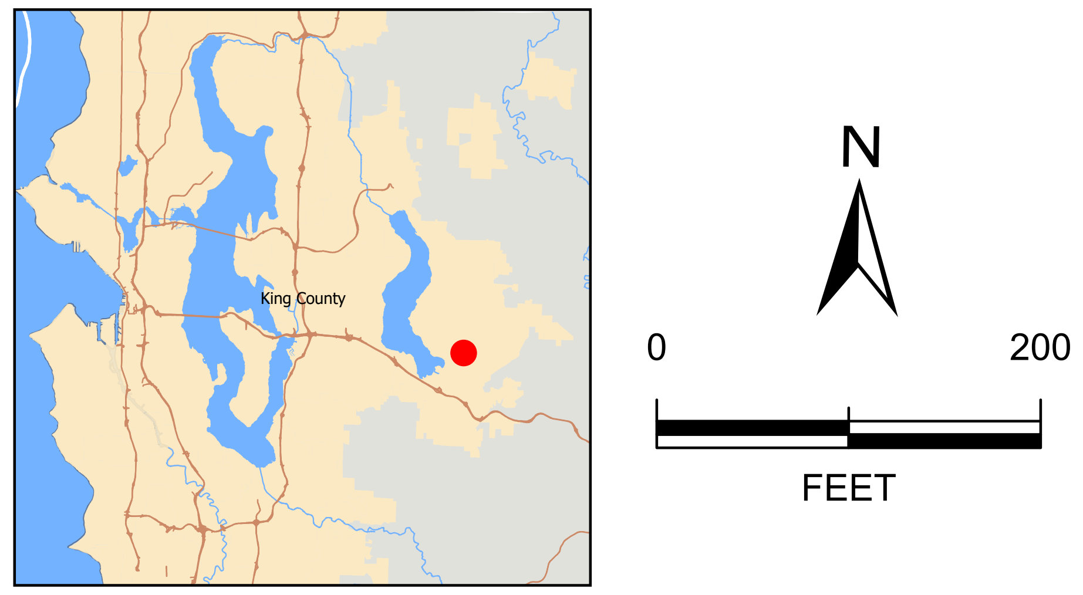
NOTE

PROPOSED SLOPES SHOWN ARE ENGINEERED SLOPES AND ARE NOT SUBJECT TO STEEP SLOPE AND **LANDSLIDE** HAZARD AREAS IN IMC 18.10.

1

DATA SOURCES / REFERENCES:
ABHL: C1.1 LU SLOPES 5/21
KING CO: STREETS, PARCELS, 3/20

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

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PROPOSED LAYOUT

ISSAQUAH HIGH SCHOOL
ISSAQUAH, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20180070E001	6/21	3

G:\GIS_Projects\aaY2018\180070 Issaquah HS Pro\aprx\180070E001 F3 SM IssHS_D__0621.aprx | 180070E001 F3 SM

PRJ19-00008 Attachment 042

LEGEND:

🟥 40% OR GREATER SLOPES

CONTOUR INTERVAL = 1'

NOTE: LOCATION AND DISTANCES SHOWN ARE APPROXIMATE.

NOTES:
1. BASE MAP REFERENCE: AHBL, ISSAQUAH HS#4 AND ES#17, SITE DEVELOPMENT PERMIT DRAWINGS, EX. SLOPES MAP, SHEET EX-1, REV 1 4/11/21

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EXISTING SLOPES EXHIBIT

ISSAQUAH HS #4 AND ES #17
ISSAQUAH, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20180070E001	6/21	4

180070 Issaquah HS \20180070E001 F4 Ex Slopes.cdr

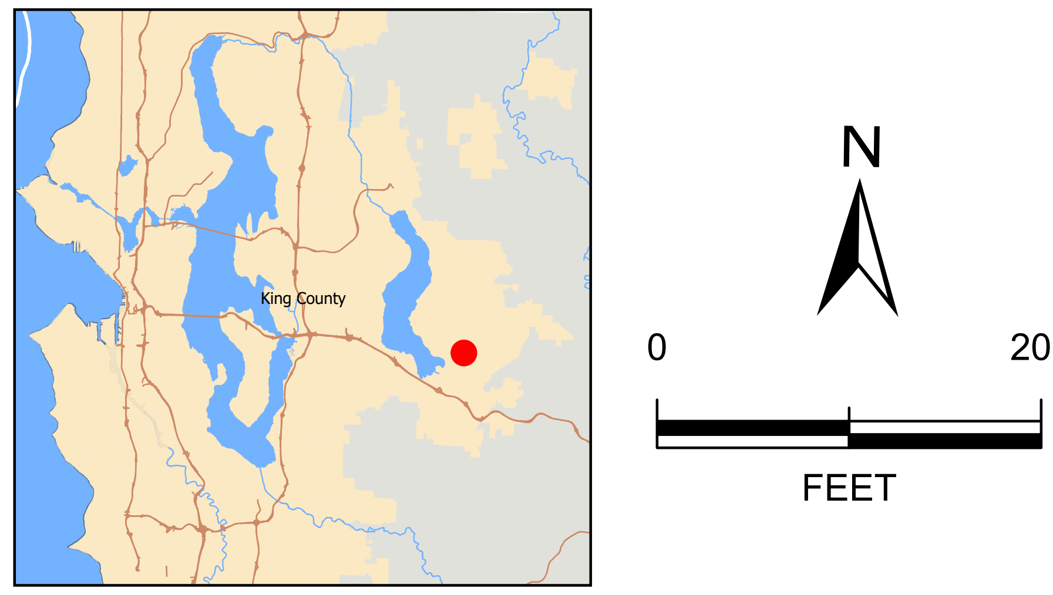
PRJ19-00008 Attachment 042

LEGEND

- 🟩 SITE
- 🟨 POST-CONSTRUCTION STEEP (>40%) SLOPES (YELLOW HIGHLIGHTS)
- 🟫 40% OR GREATER SLOPE
- 🟪 CITY BOUNDARY
- ▭ PARCEL

DATA SOURCES / REFERENCES:
ABHL: EX.1 SLOPES 4/21
KING CO: STREETS, PARCELS, 3/20

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



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POST-CONSTRUCTION STEEP SLOPES

ISSAQUAH HIGH SCHOOL
ISSAQUAH, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20180070E001	6/21	5

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PRJ19-00008 Attachment 042

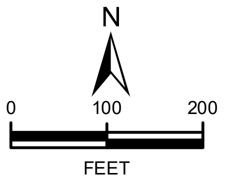
LEGEND:

🟥 SITE

▭ PARCEL

DATA SOURCES / REFERENCES:
PSLC: KING COUNTY 2016, GRID CELL SIZE IS 3'.
DELIVERY 3 FLOWN 3/2/16 - 3/29/16
KING CO: STREETS, 1/19, PARCELS 3/21

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

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LIDAR SHADED RELIEF

ISSAQUAH HS #4 AND ES #17
ISSAQUAH, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20180070E001	6/21	6

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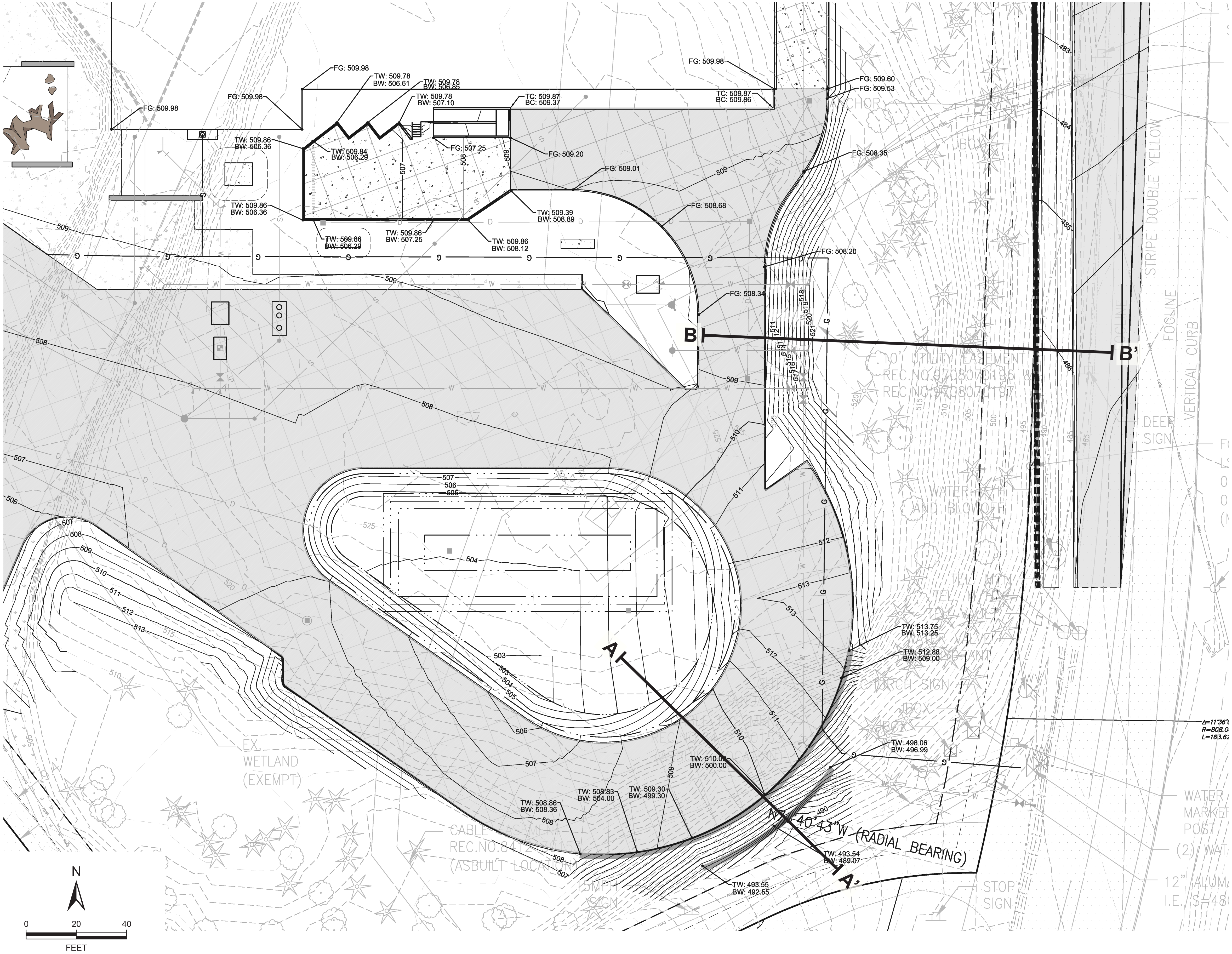
~~PRJ19-00008 Attachment 042~~



LEGEND:

CONTOUR INTERVAL = 1'

NOTE: LOCATION AND DISTANCES SHOWN ARE APPROXIMATE.

NOTES:

1. BASE MAP REFERENCE: AHBL, ISSAQUAH SCHOOL DISTRICT HIGH SCHOOL #4, GRADING PLAN, SHEET C4.7, FINAL DESIGN, 5/20/19

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STEEP SLOPE SECTION LOCATIONS

ISSAQUAH HS #4 AND ES #17
ISSAQUAH, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20180070E001	6/21	7

180070 Issaquah HS \ 20180070E001 F7 Steep Slps. cdr

APPENDIX A

Exploration Logs

PRJ19-00008 Attachment 042

Coarse-Grained Soils - More than 50%(1) Retained on No. 200 Sieve	Gravels - More than 50%(1) of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines(5)	▨	**GW**	Well-graded gravel and gravel with sand, little to no fines
			▨	**GP**	Poorly-graded gravel and gravel with sand, little to no fines
		≥12% Fines(5)	▨	**GM**	Silty gravel and silty gravel with sand
			▨	**GC**	Clayey gravel and clayey gravel with sand
	Sands - 50%(1) or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines(5)	▨	**SW**	Well-graded sand and sand with gravel, little to no fines
			▨	**SP**	Poorly-graded sand and sand with gravel, little to no fines
		≥12% Fines(5)	▨	**SM**	Silty sand and silty sand with gravel
			▨	**SC**	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50%(1) or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		▨	**ML**	Silt, sandy silt, gravelly silt, silt with sand or gravel
			▨	**CL**	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			▨	**OL**	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		▨	**MH**	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			▨	**CH**	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			▨	**OH**	Organic clay or silt of medium to high plasticity
Highly Organic Soils			▨	**PT**	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

	Density	SPT(2) blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50

	Consistency	SPT(2) blows/foot
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

(3) Estimated Percentage

Component	Percentage by Weight
Trace	<5
Some	5 to <12
Modifier (silty, sandy, gravelly)	12 to <30
Very *modifier* (silty, sandy, gravelly)	30 to <50

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch

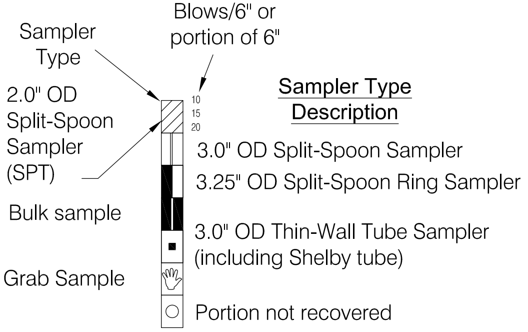
Slightly Moist - Perceptible moisture

Moist - Damp but no visible water

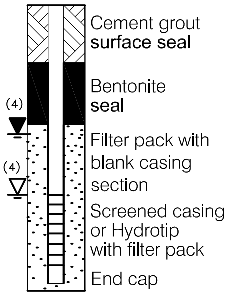
Very Moist - Water visible but not free draining

Wet - Visible free water, usually from below water table

Symbols



3.0" OD Split-Spoon Sampler
3.25" OD Split-Spoon Ring Sampler
3.0" OD Thin-Wall Tube Sampler (including Shelby tube)
Portion not recovered



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(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of ground water
▼ ATD = At time of drilling
▽ Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 12%

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

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EXPLORATION LOG KEY

FIGURE A1

blocks \ dwg \ log_key.dwg LAYOUT: Layout 4 -2014 Qty Chng

PRJ19-00008 Attachment 042

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Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-1	1 of 1

Project Name	Issaquah HS #4 and ES #17	Ground Surface Elevation (ft)	520
Location	Issaquah, WA	Datum	NAVD 88
Driller/Equipment	Advance Drilling Technology / Track Rig	Date Start/Finish	6/25/19,6/25/19
Hammer Weight/Drop	140# / 30 inches	Hole Diameter (in)	7

Depth (ft)	S T	Samples	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
			Asphalt - 3.5 inches					
			Vashon Lodgement Till					
		S-1	Moist, grayish tan, gravelly, very silty, SAND; nonstratified (SM).			16 21 12	33	
		S-2	Becomes mottled; some gravel.			7 14 19	33	
5			Contains a lens of gray silt at 5 to 6 feet.					
		S-3	Becomes very moist and gravelly below 6 feet.			6 12 23	35	
			Refusal on a rock at 7.5 feet. Moved over 2.5 feet and resumed drilling.					
10			Becomes gray.					
		S-4				19 22 18	40	
15		S-5				50/4"	50/4"	
			Bottom of exploration boring at 15.5 feet due to refusal. No groundwater encountered.					
20								
25								

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- Water Level ()
- Water Level at time of drilling (ATD)

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Approved by: CJK

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Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-2	1 of 1

Project Name: Issaquah HS #4 and ES #17
Location: Issaquah, WA
Driller/Equipment: Advance Drilling Technology / Track Rig
Hammer Weight/Drop: 140# / 30 inches

Ground Surface Elevation (ft): 524
Datum: NAVD 88
Date Start/Finish: 6/25/19,6/25/19
Hole Diameter (in): 7

Depth (ft)	S T	Samples	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot	Other Tests
0			**Forest Duff - 4 inches**					
			Vashon Lodgement Till					
	◫	S-1	Moist, reddish brown, gravelly, very silty, SAND (SM).			6 8 12	▲20	
	◫	S-2	Becomes tan.			6 14 14	▲28	
5	◫	S-3	Blowcounts are likely overstated, pounding on a rock.			50/4"	▲50/4"	
			Difficult drilling.					
10	◫	S-4	Becomes mottled and very gravelly.			20 50/5"	▲50/5"	
			Bottom of exploration boring at 11 feet due to refusal. No groundwater encountered. Moved over 3 feet and attempted to re-drill. Met refusal at 7.5 feet.					
15								
20								
25								

Sampler Type (ST):

◫ 2" OD Split Spoon Sampler (SPT)	☐ No Recovery	M - Moisture
◫ 3" OD Split Spoon Sampler (D & M)	◧ Ring Sample	▽ Water Level ()
✋ Grab Sample	▨ Shelby Tube Sample	▼ Water Level at time of drilling (ATD)

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Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-3	1 of 1

Project Name	Issaquah HS #4 and ES #17	Ground Surface Elevation (ft)	525
Location	Issaquah, WA	Datum	NAVD 88
Driller/Equipment	Advance Drilling Technology / Track Rig	Date Start/Finish	6/25/19,6/25/19
Hammer Weight/Drop	140# / 30 inches	Hole Diameter (in)	7

Depth (ft)	S T	Samples	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot	Other Tests
			Forest Duff / Topsoil - 6 inches					
		S-1	**Blakely Harbor Formation** Moist, mottled light brown, very silty, SAND, trace to some gravel (SM).			2 5 5	10	
		S-2				8 8 11	19	
5		S-3				6 9 13	22	
10		S-4	Becomes very moist.			7 11 19	30	
15		S-5	Trace fine gravel.			6 9 30	39	
20		S-6	Becomes tan gray with heavy orange brown mottling. Contains coal fragments.			12 13 22	35	
25		S-7	Becomes gravelly.			28 50/5"	50/5"	
			Bottom of exploration boring at 26 feet No groundwater encountered.					

Sampler Type (ST):

- ▯ 2" OD Split Spoon Sampler (SPT)
- ▯ 3" OD Split Spoon Sampler (D & M)
- ▯ Grab Sample
- ☐ No Recovery
- ◧ Ring Sample
- ▨ Shelby Tube Sample
- M - Moisture
- ▽ Water Level ()
- ▼ Water Level at time of drilling (ATD)

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Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-4	1 of 1

Project Name Issaquah HS #4 and ES #17
Location Issaquah, WA
Driller/Equipment Advance Drilling Technology / Track Rig
Hammer Weight/Drop 140# / 30 inches

Ground Surface Elevation (ft) 514
Datum NAVD 88
Date Start/Finish 6/25/19,6/25/19
Hole Diameter (in) 7

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Fill					
		S-1		Very moist, reddish brown, very silty, gravelly, SAND; nonstratified (SM).			5 4 5	9	
				Blakely Harbor Formation					
		S-2		Very moist, reddish brown, gravelly, very silty, fine SAND; gravel fraction consists of angular sandstone fragments (SM).			2 2 3	5	
5		S-3		Becomes tan and silty.			4 5 13	18	
10		S-4		Contains angular gray gravel; poor recovery.			21 50 50/6"	50/6"	
15		S-5					38 50/3"	50/3"	
20		S-6		Becomes gray and more lithified.			50/5"	50/5"	
				Bottom of exploration boring at 20 feet due to refusal. No groundwater encountered.					
25									

Sampler Type (ST):

- ▯ 2" OD Split Spoon Sampler (SPT)
- ▯ 3" OD Split Spoon Sampler (D & M)
- ✋ Grab Sample
- ☐ No Recovery
- ◧ Ring Sample
- ▨ Shelby Tube Sample
- M - Moisture
- ▽ Water Level ()
- ▼ Water Level at time of drilling (ATD)

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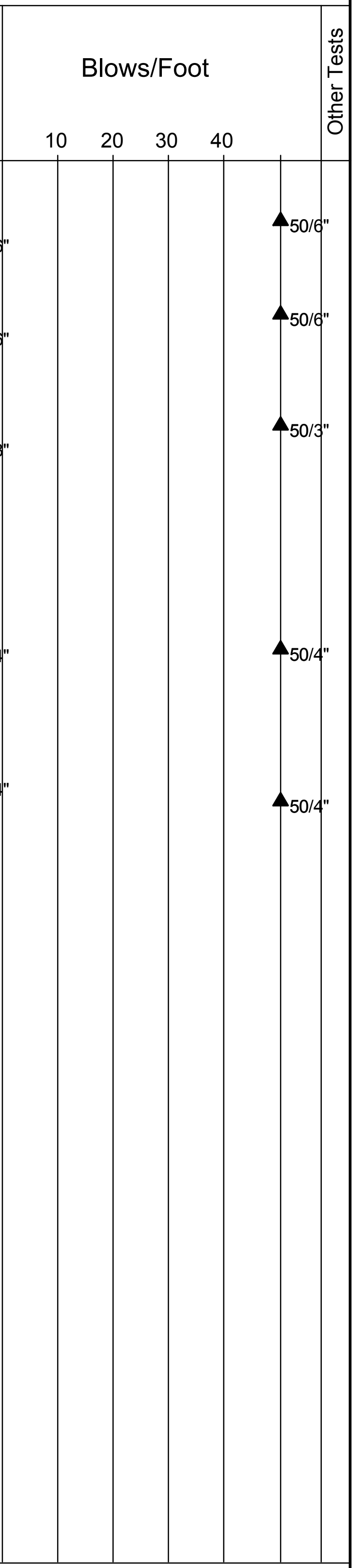
Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-5	1 of 1

Project Name: Issaquah HS #4 and ES #17
Location: Issaquah, WA
Driller/Equipment: Advance Drilling Technology / Track Rig
Hammer Weight/Drop: 140# / 30 inches

Ground Surface Elevation (ft): 520
Datum: NAVD 88
Date Start/Finish: 6/25/19,6/25/19
Hole Diameter (in): 7

Depth (ft)	ST	Samples	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot
			Asphalt - 1.5 inches thick				
			Vashon Lodgement Till				
		S-1	Moist, brown, very gravelly, very silty, SAND; rounded gravel (SM).			18 19 50/6"	50/6"
			Blakely Harbor Formation				
		S-2	Moist, gray, silty, SAND; contains angular rock fragments (SM).			22 38 50/6"	50/6"
5		S-3	Orange brown mottling.			28 33 50/3"	50/3"
10		S-4	Becomes more heavily mottled.			18 50/4"	50/4"
		S-5				50/4"	50/4"
			Bottom of exploration boring at 14 feet due to refusal. No groundwater encountered.				
15							
20							
25							



Sampler Type (ST):

- ▯ 2" OD Split Spoon Sampler (SPT)
- ▯ 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- ☐ No Recovery
- ◧ Ring Sample
- ▨ Shelby Tube Sample
- M - Moisture
- ▽ Water Level ()
- ▼ Water Level at time of drilling (ATD)

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Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-6	1 of 1

Project Name: Issaquah HS #4 and ES #17
Location: Issaquah, WA
Driller/Equipment: Advance Drilling Technology / Track Rig
Hammer Weight/Drop: 140# / 30 inches

Ground Surface Elevation (ft): 520
Datum: NAVD 88
Date Start/Finish: 6/26/19,6/26/19
Hole Diameter (in): 7

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot	Other Tests
				Asphalt - 2 inches					
				Vashon Lodgement Till					
		S-1		Moist, grayish tan, gravelly, very silty, SAND; nonstratified (SM).			8 10 15	25	
		S-2		Some gravel.			12 21 27	48	
5		S-3		Trace gravel; contains scattered thin lenses (<1/8 inches thick) of fine sand.			18 11 18	29	
				Blakely Harbor Formation					
				Gravelly drilling at 9 feet.					
10		S-4		Moist, yellowish tan to gray, silty, SAND; contains angular rock fragments (SM).			50/6"	50/6"	
		S-5					46 50/3"	50/3"	
				Bottom of exploration boring at 12.25 feet due to refusal. No groundwater encountered.					
15									
20									
25									

Sampler Type (ST):

2" OD Split Spoon Sampler (SPT)	No Recovery	M - Moisture
3" OD Split Spoon Sampler (D & M)	Ring Sample	⊻ Water Level ()
Grab Sample	Shelby Tube Sample	▼ Water Level at time of drilling (ATD)

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Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-7	1 of 1

Project Name: Issaquah HS #4 and ES #17
Location: Issaquah, WA
Driller/Equipment: Advance Drilling Technology / Track Rig
Hammer Weight/Drop: 140# / 30 inches

Ground Surface Elevation (ft): 520
Datum: NAVD 88
Date Start/Finish: 6/26/19,6/26/19
Hole Diameter (in): 7

Samples	DESCRIPTION	Blows/6"	Blows/Foot
	Asphalt - 2.5 inches		
S-1	**Vashon Lodgement Till** Moist, grayish tan, gravelly, very silty, SAND; nonstratified (SM).	8 6 10	16
S-2		10 18 50/5"	50/5"
S-3	Poor recovery, driving a rock. Very difficullt drilling.	25 50/5"	50/5"
S-4	Becomes yellowish tan, very gravelly.	14 46 50/5"	50/5"
S-5	No recovery.	50/1"	50/1"

Bottom of exploration boring at 10 feet due to refusal.
No groundwater encountered.

Depth (ft): 5, 10, 15, 20, 25

Sampler Type (ST):
- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- Water Level ()
- Water Level at time of drilling (ATD)

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Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-8	1 of 1

Project Name: Issaquah HS #4 and ES #17
Location: Issaquah, WA
Driller/Equipment: Advance Drilling Technology / Track Rig
Hammer Weight/Drop: 140# / 30 inches

Ground Surface Elevation (ft): 520
Datum: NAVD 88
Date Start/Finish: 6/26/19,6/26/19
Hole Diameter (in): 7

Depth (ft)	Samples	DESCRIPTION	Blows/6"	Blows/Foot
		Fill		
	S-1	Moist, tan, gravelly, very silty, SAND (SM).	1 2 2	4
	S-2	Trace tile debris.	3 3 4	7
		Vashon Lodgement Till		
5	S-3	Moist, grayish tan, gravelly, very silty, SAND; nonstratified (SM).	5 10 14	24
10	S-4	Becomes very moist.	14 25 36	61
		Drilling action becomes smoother at 12 feet.		
		Drilling action becomes gravelly.		
15	S-5		18 36 36	72
20	S-6	Becomes mottled with increased moisture.	16 15 20	35
		Possession Drift		
		Very moist, blue gray, SILT; contains fine sand partings; massive; effervesces in hydrochloric acid (ML).		
25	S-7	Becomes laminated.	9 12 16	28
		Bottom of exploration boring at 26.5 feet No groundwater encountered.		

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- Water Level ()
- Water Level at time of drilling (ATD)

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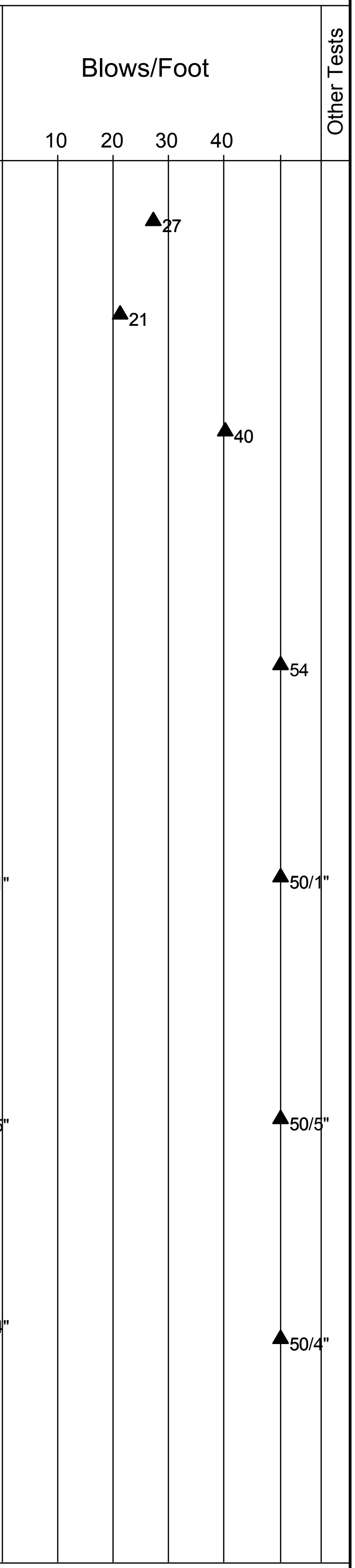
Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-9	1 of 1

Project Name	Issaquah HS #4 and ES #17	Ground Surface Elevation (ft)	500
Location	Issaquah, WA	Datum	NAVD 88
Driller/Equipment	Advance Drilling Technology / Track Rig	Date Start/Finish	6/26/19,6/26/19
Hammer Weight/Drop	140# / 30 inches	Hole Diameter (in)	7

Depth (ft)	Samples	DESCRIPTION	Blows/6"	Blows/Foot
		Asphalt - 1.5 inches		
	S-1	**Fill** Moist, grayish tan and brown (mixed), gravelly, very silty, SAND; contains scattered organic debris (SM).	12 16 11	27
	S-2	**Vashon Lodgement Till** Very moist, tan gray, very silty, gravelly, SAND; nonstratified (SM).	6 9 12	21
5	S-3	Becomes tan to grayish tan.	8 16 24	40
10	S-4	Becomes moist.	16 24 30	54
15	S-5	Becomes very moist.	48 50/1"	50/1"
20	S-6		33 50/5"	50/5"
25	S-7	Poor recovery.	50/4"	50/4"

Bottom of exploration boring at 25.5 feet
No groundwater encountered.



Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture
▽ Water Level ()
▼ Water Level at time of drilling (ATD)

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Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-10	1 of 1

Project Name Issaquah HS #4 and ES #17
Location Issaquah, WA
Driller/Equipment Advance Drilling Technology / Track Rig
Hammer Weight/Drop 140# / 30 inches

Ground Surface Elevation (ft) 465
Datum NAVD 88
Date Start/Finish 6/26/19,6/26/19
Hole Diameter (in) 7

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Blakely Harbor Formation					
		S-1		Very moist, brown to tan, very silty, gravelly, SAND (SM).			5 5 8	13	
		S-2					9 15 18	33	
				Becomes moist, grayish tan, silty with angular gravel sized sedimentary rock fragments.					
5		S-3		Becomes tan to yellowish tan.			11 15 22	37	
10		S-4		Becomes mottled and fine grained (siltstone); angular rock fragments still present.			50/5"	50/5"	
15		S-5					13 29 50/5"	50/5"	
20		S-6		Poor recovery.			50/2"	50/2"	
25									

Bottom of exploration boring at 20 feet due to refusal.
No groundwater encountered.

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- ☐ No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- ▽ Water Level ()
- ▼ Water Level at time of drilling (ATD)

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Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-11	1 of 3

Project Name Issaquah HS #4 and ES #17
Location Issaquah, WA
Driller/Equipment Advance Drilling Technology / Track Rig
Hammer Weight/Drop 140# / 30 inches
Ground Surface Elevation (ft) 500
Datum NAVD 88
Date Start/Finish 6/27/19,6/27/19
Hole Diameter (in) 7

Depth (ft)	Samples	DESCRIPTION	Blows/6"	Blows/Foot
		Vashon Lodgement Till		
	S-1	Very moist, grayish tan, very silty, gravelly, SAND; nonstratified (SM).	6 9 9	18
	S-2	Becomes moist.	29 50/6"	50/6"
		Met with refusal at 4 feet; moved over 4 feet and resumed drilling.		
5	S-3		4 37 50/5"	50/5"
10	S-4	Becomes very moist.	50/3"	50/3"
15	S-5	Becomes very moist.	14 50/4"	50/4"
20	S-6		50/6"	50/6"
25	S-7	Becomes very moist, slightly less gravelly, and sightly more silty.	13 21 30	51
		Driller adding water (~1 to 2 gallons).		
		Olympia Nonglacial Sediments ?		
		Drilling action becomes smooth below ~28 feet.		

Sampler Type (ST):

2" OD Split Spoon Sampler (SPT)	☐ No Recovery	M - Moisture
3" OD Split Spoon Sampler (D & M)	▮ Ring Sample	▽ Water Level ()
Grab Sample	Shelby Tube Sample	▼ Water Level at time of drilling (ATD)

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Exploration Boring

PRJ19-00008 Attachment 042

Project Number	Exploration Number	Sheet
180070E001	EB-11	2 of 3

Project Name Issaquah HS #4 and ES #17
Location Issaquah, WA
Driller/Equipment Advance Drilling Technology / Track Rig
Hammer Weight/Drop 140# / 30 inches

Ground Surface Elevation (ft) 500
Datum NAVD 88
Date Start/Finish 6/27/19,6/27/19
Hole Diameter (in) 7

Depth (ft)	S T	Samples	DESCRIPTION	Blows/6"	Blows/Foot
		S-8	Moist, tan gray, fine to medium SAND, some silt (SP-SM).	18 30 41	71
		S-9	Sand becomes tan, silty, and fine grained. Moist, tan, SILT; nonplastic; massive; driller adding water (ML).	27 39 50/6"	50/6"
35		S-10		11 37 50/5"	50/5"
		S-11	Trace gravel.	27 50/6"	50/6"
40		S-12	Contains a lens (~3 inches thick) of lightly mottled, fine sandy, silt at ~40.5 feet.	20 39 50	50/6"
45		S-13		12 20 33	53
			Pre-Fraser Till Gravelly drilling action at 48 feet.		
50		S-14	Moist, grayish tan, very silty, gravelly, SAND; nonstratified (SM).	20 32 48	80
55		S-15	Slight increase in moisture content. Becomes very moist and gray.	12 33 50/5"	50/5"

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- ▽ Water Level ()
- ▼ Water Level at time of drilling (ATD)

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Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-11	3 of 3

Project Name Issaquah HS #4 and ES #17
Location Issaquah, WA
Driller/Equipment Advance Drilling Technology / Track Rig
Hammer Weight/Drop 140# / 30 inches

Ground Surface Elevation (ft) 500
Datum NAVD 88
Date Start/Finish 6/27/19,6/27/19
Hole Diameter (in) 7

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
		S-16					13 33 50/6"	50/6"	
				Driller adding water.					
65		S-17					16 22 27	49	
				Pre-Fraser Silt Drilling action becomes smooth below 68 feet.					
70		S-18		Moist, mottled tan, SILT; nonplastic; contains thin sand lens (~1 inch thick) at 71 feet; non-reactive in hydrochloric acid (ML).			17 27 40	67	
75		S-19		Moist, grayish tan, very silty, fine SAND; frequent thin lenses (~2 inches thick) of silt (SM).			16 27 46	73	
80		S-20		**Blakely Harbor Formation** Gravelly drilling action at 80 feet. Moist, gray, very silty, gravelly, SAND; nonstratified (SM).			50/6"	50/6"	
85		S-21		Becomes greenish gray, very gravelly, and contains pink rock fragments.			40 50/3"	50/3"	
				Bottom of exploration boring at 85.75 feet No groundwater encountered.					

Sampler Type (ST):

2" OD Split Spoon Sampler (SPT)	No Recovery	M - Moisture
3" OD Split Spoon Sampler (D & M)	Ring Sample	▽ Water Level ()
Grab Sample	Shelby Tube Sample	▼ Water Level at time of drilling (ATD)

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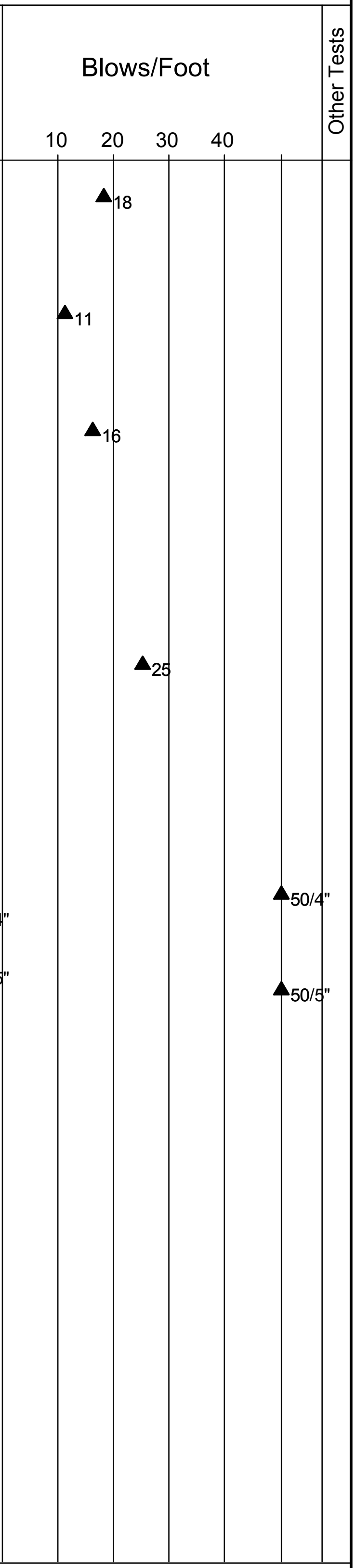
Exploration Boring

Project Number	Exploration Number	Sheet
180070E001	EB-12	1 of 1

Project Name: Issaquah HS #4 and ES #17
Location: Issaquah, WA
Driller/Equipment: Advance Drilling Technology / Track Rig
Hammer Weight/Drop: 140# / 30 inches

Ground Surface Elevation (ft): 505
Datum: NAVD 88
Date Start/Finish: 6/28/19,6/28/19
Hole Diameter (in): 7

Depth (ft)	Samples	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot	Other Tests
	S-1	**Vashon Lodgement Till** Very moist, mottled tan, very silty, gravelly, SAND; nonstratified (SM).			5 9 9	18	
	S-2	**Vashon Ice Contact** Very moist, mottled tan, fine sandy, SILT, some gravel; nonplastic (ML).			4 5 6	11	
5	S-3	Trace to some gravel.			4 6 10	16	
10	S-4	No gravel. Becomes blue gray below 11 feet.			5 10 15	25	
15	S-5	**Blakely Harbor Formation** Gravelly drilling action below 14.5 feet. Moist, purplish gray, silty, fine SAND, trace organics (SM).			15 41 50/4"	50/4"	
	S-6	Becomes purplish greenish gray and fine to medium grained with some pebble gravel.			50/5"	50/5"	
		Bottom of exploration boring at 18 feet due to refusal. No groundwater encountered.					
20							
25							



Sampler Type (ST):

- ◫ 2" OD Split Spoon Sampler (SPT)
- ◫ 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- ☐ No Recovery
- ◧ Ring Sample
- ▱ Shelby Tube Sample
- M - Moisture
- ▽ Water Level ()
- ▼ Water Level at time of drilling (ATD)

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PRJ19-00008 Attachment 042

EXPLORATION PIT NO. EP-1

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 505 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, very moist, brown, very silty, gravelly, SAND; abundant roots (SM).
2	Becomes medium dense and tan below 2 feet.
3	
	Vashon Lodgement Till
4	Hard, very moist, grayish tan, fine sandy, SILT; oxidized fracture surfaces; nonstratified (ML).
5	
6	Trace to some gravel below 6 feet.
7	
8	
9	Bottom of exploration pit at depth 8.5 feet No seepage. No caving.
10	
11	
12	
13	
14	
15	

Issaquah HS #4 and ES #17
Issaquah, WA

Logged by: TJP

Approved by: CJK

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Project No. 180070E001

12/12/18

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EXPLORATION PIT NO. EP-2

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 510 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, wet, reddish brown, very silty, gravelly, SAND (SM).
2	Abundant roots to 2.5 feet. Becomes medium dense, very moist, and grayish tan below 2.5 feet.
3	
	Vashon Lodgement Till
4	Very dense, moist, grayish tan, very silty, gravelly, SAND; nonstratified (SM).
5	
6	
7	
8	Bottom of exploration pit at depth 8 feet No seepage. No caving.
9	
10	
11	
12	
13	
14	
15	

Issaquah HS #4 and ES #17
Issaquah, WA

Logged by: TJP

Approved by: CJK

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Project No. 180070E001

12/12/18

KCTP3 180070.GPJ January 9, 2020

EXPLORATION PIT NO. EP-3

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 485 ft
	Topsoil - 8 inches
1	**Weathered Vashon Lodgement Till** Loose, very moist, brown to reddish brown, very silty, gravelly, SAND (SM).
2	
3	Abundant roots 0 to 2.5 feet. Becomes medium dense, increased moisture, and grayish tan with mottling below 2.5 feet.
4	**Vashon Lodgement Till** Dense, very moist, grayish tan, very silty, gravelly, SAND; scattered cobbles; mottled above 5 feet (sandy till); nonstratified (SM).
5	
6	
7	
8	Bottom of exploration pit at depth 8 feet No seepage. No caving.
9	
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15	

Issaquah HS #4 and ES #17
Issaquah, WA

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EXPLORATION PIT NO. EP-4

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 480 ft
	Topsoil - 10 inches
1	**Blakely Harbor Formation** Loose, very moist, brown, very silty, SAND, some gravel; abundant roots (SM).
2	
3	Soft to medium stiff, very moist to wet, yellowish tan, SILT (ML).
4	
5	
6	Medium dense to dense, very moist, yellowish tan, very silty, fine SAND (SM) and hard, fine sandy, SILT (ML); stratified (sandstone/siltstone).
7	
8	
9	
10	Bottom of exploration pit at depth 9 feet Moderately rapid seepage 2 to 4 feet. Moderate sloughing 2 to 4 feet.
11	
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EXPLORATION PIT NO. EP-5

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 476 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose to medium dense, very moist, brown, very silty, gravelly, SAND; scattered cobbles; abundant roots (SM).
2	**Blakely Harbor Formation**
	Medium dense to dense, very moist, yellowish tan, very silty, SAND (SM).
3	
4	
5	
6	Becomes very dense below 6 feet.
7	
	Bottom of exploration pit at depth 7 feet No seepage. No caving.
8	
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EXPLORATION PIT NO. EP-6

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 482 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, very moist, reddish brown, very silty, gravelly, SAND (SM). Abundant roots 0 to 2 feet.
2	Becomes medium dense and tan below 2 feet.
3	**Vashon Lodgement Till** Dense, very moist, mottled grayish tan, very silty, gravelly, SAND; scattered cobbles and boulders;
4	nonstratified (SM).
5	
6	
7	Wet at 7 feet.
8	
9	Bottom of exploration pit at depth 9 feet Slow discontinuous seepage at 7 feet. No caving.
10	
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15	

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EXPLORATION PIT NO. EP-7

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 505 ft
0–1	**Fill** Loose, very moist, brown, very silty, gravelly, SAND (SM).
1–5	**Vashon Lodgement Till** Very dense, moist, tan gray, very silty, gravelly, SAND; nonstratified (SM). Very difficult digging.
5	Bottom of exploration pit at depth 5 feet No seepage. No caving.
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14	
15	

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EXPLORATION PIT NO. EP-8

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 500 ft
	Fill
	Loose, moist, brown, very silty, gravelly, SAND (SM).
1	
2	
3	Abundant roots 0 to 4 feet
4	Becomes tan below 4 feet.
5	
6	
7	
8	**Weathered Vashon Lodgement Till**
	Medium dense, moist, reddish brown, very silty, gravelly, SAND (SM).
9	
10	Clay pipe encountered at 10 feet in north end of excavation.
	Vashon Lodgement Till
11	Very dense, moist, grayish tan, very silty, SAND, some gravel; nonstratified (SM).
	Bottom of exploration pit at depth 11 feet No seepage. No caving.
12	
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14	
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EXPLORATION PIT NO. EP-9

Depth (ft)	DESCRIPTION Elev: 510 ft
	Fill Loose, very moist, brown, very silty, SAND, some gravel; contains pockets of clean sand (SM).
1	**Vashon Lodgement Till** Very dense, moist, grayish tan, very silty, gravelly, SAND; scattered cobbles and boulders; nonstratified (SM).
2	
3	
4	
5	
6	
7	Bottom of exploration pit at depth 7 feet No seepage. No caving.
8	
9	
10	
11	
12	
13	
14	
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EXPLORATION PIT NO. EP-10

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 512 ft
	Weathered Vashon Lodgement Till Loose, very moist, brown, very silty, gravelly, SAND; abundant roots; wet at base (SM).
1	**Vashon Lodgement Till**
2	Very dense, very moist, grayish tan, very silty, gravelly, SAND; scattered boulders and cobbles; nonstratified (SM). Becomes moist below ~2.5 feet.
3	
4	
5	
6	
7	Bottom of exploration pit at depth 6 feet Refusal due to boulder. Slow seepage at 1 foot. No caving.
8	
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EXPLORATION PIT NO. EP-11

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 512 ft
	Fill
	Loose, very moist to wet, brown, very silty, gravelly, SAND; contains trace wood debris (SM).
1	
2	Clay pipe and wires encountered at ~2 and 3 feet.
3	
4	
5	
6	**Vashon Lodgement Till**
	Very dense, very moist, grayish tan, very silty, gravelly, SAND; nonstratified (SM).
7	Bottom of exploration pit at depth 7 feet Slow seepage at ~2 feet. Moderately severe caving at ~2 feet.
8	
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EXPLORATION PIT NO. EP-12

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 492 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Dense, moist to very moist, reddish brown, very silty, gravelly, SAND; abundant roots (SM).
2	
3	
4	**Vashon Lodgement Till** Very dense, very moist, grayish tan, very silty, gravelly, SAND; nonstratified (SM).
5	Bottom of exploration pit at depth 5 feet No seepage. No caving. Broke water line during excavation; repaired.
6	
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EXPLORATION PIT NO. EP-13

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 485 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, very moist, reddish brown, very silty, gravelly, SAND (SM).
2	
	Abundant roots 0 to 2.5 feet. Becomes medium dense and grayish tan below 2.5 feet. Wet at base.
3	**Vashon Lodgement Till**
	Very dense, moist, grayish tan, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM).
4	
5	
6	
7	
8	
	Bottom of exploration pit at depth 8 feet Slow seepage at 3 feet. No caving.
9	
10	
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13	
14	
15	

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EXPLORATION PIT NO. EP-14

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 476 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, very moist, reddish brown, very silty, gravelly, SAND (SM).
2	
	Wet at 2.5 feet. Abundant roots 0 to 2.5 feet.
3	Becomes medium dense, very moist, and tan below 3 feet.
	Vashon Lodgement Till
4	Dense, very moist, tan, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM).
	Lightly mottled 3.5 to 4.5 feet. Becomes very dense below 4.5 feet.
5	
6	
7	
	Bottom of exploration pit at depth 7 feet Slow seepage at 2.5 feet. No caving.
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EXPLORATION PIT NO. EP-15

Depth (ft)	DESCRIPTION Elev: 477 ft
	Topsoil - 8 inches
1	**Weathered Vashon Lodgement Till** Loose, very moist, reddish brown, gravelly, very silty, SAND; scattered cobbles (SM).
2	
3	Wet at 2.5 feet. Abundant roots 0 to 2.5 feet. Becomes medium dense and tan below 2.5 feet.
4	**Vashon Lodgement Till** Dense, very moist, grayish tan, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM). Mottled 3.5 to 5 feet.
5	
6	Becomes very dense below ~6 feet.
7	
8	
9	Bottom of exploration pit at depth 8 feet Moderately rapid seepage at 2.5 feet. No caving.
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14	
15	

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EXPLORATION PIT NO. EP-16

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 480 ft
	Forest Duff
	Fill
1	Very dense, moist, grayish brown, very silty, gravelly, SAND; scattered cobbles (SM).
2	Medium dense to dense, moist, grayish brown, very gravelly, fine to medium SAND, trace silt; scattered cobbles (SP).
	Abundant wood debris below ~2.5 feet.
3	Pockets of silty, sand below 3 feet.
4	**Vashon Lodgement Till**
	Dense, very moist, gray, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM).
5	
6	Becomes tan gray below 6 feet.
7	
8	
	Bottom of exploration pit at depth 8 feet No seepage. No caving.
9	
10	
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EXPLORATION PIT NO. EP-17

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Elev: 489 ft

Topsoil - 6 inches

Weathered Vashon Lodgement Till

1 Loose, very moist, reddish brown, very silty, gravelly, SAND (SM).

2

Abundant roots 0 to 3 feet.

3 Becomes medium dense and tan below 3 feet.

4

5

Vashon Lodgement Till

Dense, very moist, grayish tan, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM).

6

7 Becomes very dense below 7 feet.

8

Bottom of exploration pit at depth 8 feet
No seepage. No caving.

9

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Issaquah, WA

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EXPLORATION PIT NO. EP-18

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 501 ft
	Topsoil - 6 inches
1	**Fill** Medium dense, moist to very moist, grayish tan, fine to medium SAND, some silt; scattered wood debris; wet at 2 feet (SP-SM).
2	**Vashon Lodgement Till** Very dense, very moist, grayish tan, very silty, gravelly, SAND; nonstratified (SM).
3	
4	
5	Bottom of exploration pit at depth 4.5 feet Refusal due to a large boulder. Slow seepage at 2 feet. No caving.
6	
7	
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EXPLORATION PIT NO. EP-19

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 502 ft
	Sod / Topsoil - 6 inches
1	**Weathered Vashon Lodgement Till** Medium dense, very moist, brown, gravelly, silty, SAND; wet at 1.5 feet (SM).
2	**Vashon Lodgement Till** Very dense, wet, grayish tan, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM).
3	
4	
5	
6	
7	
8	Bottom of exploration pit at depth 7 feet Slow seepage at 1.5 feet. No caving.
9	
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-20

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 499 ft
	Sod / Topsoil - 6 inches
	Vashon Lodgement Till
1	Very dense, very moist, grayish tan, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM).
2	Becomes moist below ~1 foot.
3	
4	Becomes tan gray below ~4 feet.
5	
6	Very difficult digging.
	Bottom of exploration pit at depth 6 feet No seepage. No caving.
7	
8	
9	
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-21

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 490 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, moist, reddish brown to brown, very silty, gravelly, SAND (SM).
2	Abundant roots 0 to 2 feet. Becomes medium dense, very moist, and tan below 2 feet.
3	Wet at 3.5 feet.
	Vashon Lodgement Till
4	Very dense, moist, grayish tan, very silty, gravelly, SAND; nonstratified (SM). Mottled 3.5 to 4.5 feet.
5	
6	
7	
8	
9	
10	Bottom of exploration pit at depth 9.5 feet Slow seepage at 3.5 feet. No caving.
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-22

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 478 ft
	Topsoil - 8 inches
1	**Weathered Vashon Lodgement Till** Loose, moist, reddish brown, very silty, gravelly, SAND (SM). Abundant roots 0 to 2 feet.
2	Becomes medium dense, very moist, and tan below 2 feet.
3	
4	**Vashon Lodgement Till** Dense, moist, tan, very silty, gravelly, SAND; nonstratified (SM).
5	Mottled 4 to 5 feet. Very dense and grayish tan below 5 feet.
6	
7	
8	
9	Bottom of exploration pit at depth 8.5 feet No seepage. No caving.
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-23

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 460 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, moist, reddish brown, very silty, gravelly, SAND (SM).
2	Becomes medium dense and tan below 2 feet. Abundant roots 0 to 2 feet.
3	**Vashon Lodgement Till**
	Very dense, moist, grayish tan, very silty, gravelly, SAND; nonstratified (SM).
4	
5	
6	
7	
8	
	Bottom of exploration pit at depth 8 feet No seepage. No caving.
9	
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-24

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Elev: 445 ft

Topsoil - 6 inches

Weathered Vashon Lodgement Till

1 Loose, moist, reddish brown, very silty, gravelly, SAND (SM).

2

Becomes medium dense and tan below 2.5 feet.

3

Vashon Lodgement Till

4 Very dense, moist, grayish tan, very silty, gravelly, SAND; scattered cobbles and boulders; nonstratified (SM).

5 Mottled 3.5 to 4.5 feet.

6

7

8

9

Bottom of exploration pit at depth 9 feet
No seepage. No caving.

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EXPLORATION PIT NO. EP-25

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 425 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, moist, reddish brown, very silty, gravelly, SAND (SM).
2	
3	Abundant roots 0 to 3 feet. Becomes medium dense and tan below 3 feet.
4	
	Vashon Lodgement Till
5	Very dense, moist, grayish tan, very silty, gravelly, SAND; scattered boulders and cobbles; nonstratified (SM). Mottled 4.5 to 6 feet.
6	
7	
8	
9	
10	Bottom of exploration pit at depth 10 feet No seepage. No caving.
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-26

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Elev: 420 ft

Depth (ft)	DESCRIPTION
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, moist, reddish brown, very silty, SAND, some gravel (SM).
2	Abundant roots 0 to 2 feet. Becomes medium dense, very moist, and tan below 2 feet.
3	**Vashon Lodgement Till**
	Very dense, moist, grayish tan, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM).
4	Mottled 3 to 4 feet.
5	
6	
7	
8	
	Bottom of exploration pit at depth 8 feet No seepage. No caving.
9	
10	
11	
12	
13	
14	
15	

Issaquah HS #4 and ES #17
Issaquah, WA

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Approved by: CJK

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Project No. 180070E001

12/10/18

EXPLORATION PIT NO. EP-27

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 425 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, moist, reddish brown, very silty, gravelly, SAND; scattered cobbles (SM).
	Medium dense, very moist, and tan below 1.5 feet. Abundant roots 0 to 1.5 feet.
2	
	Vashon Lodgement Till
3	Very dense, moist, grayish tan, very silty, gravelly, SAND; nonstratified (SM).
4	
5	
6	
7	
8	
	Bottom of exploration pit at depth 8 feet No seepage. No caving.
9	
10	
11	
12	
13	
14	
15	

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Project No. 180070E001
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EXPLORATION PIT NO. EP-28

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 460 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose, moist, reddish brown, very silty, gravelly, SAND (SM).
2	
3	Abundant roots 0 to 2.5 feet. Becomes medium dense, very moist, and tan below 2.5 feet.
4	**Vashon Lodgement Till**
5	Very dense, moist, tan, very silty, gravelly, SAND; scattered cobbles (SM).
6	
7	
8	
9	Bottom of exploration pit at depth 8 feet No seepage. No caving.
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-29

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 460 ft
	Topsoil - 6 inches
	Weathered Vashon Lodgement Till
1	Loose to medium dense, moist, reddish brown, very silty, gravelly, SAND; abundant roots (SM).
2	
3	
	Vashon Lodgement Till
4	Mottled 3.5 to 4.5 feet. Dense to very dense, moist, grayish tan, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM).
5	
6	Grades to tan gray below ~6 feet.
7	
8	
9	
	Bottom of exploration pit at depth 9 feet No seepage. No caving.
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-30

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 485 ft
	Topsoil - 8 inches
1	**Weathered Vashon Lodgement Till** Loose, moist, brown, very silty, gravelly, SAND (SM). Abundant roots 0 to 1.5 feet.
2	
3	Becomes medium dense, very moist, and tan below 2.5 feet.
4	
5	
6	**Vashon Lodgement Till** Dense, moist, light yellowish tan, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM).
7	
8	Bottom of exploration pit at depth 8 feet No seepage. No caving. Note: The color and density of the Till at this location suggests that it contains a significant percentage of reworked material from the underlying bedrock.
9	
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-31

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 490 ft
	Topsoil - 8 inches
1	**Weathered Vashon Lodgement Till** Loose to medium dense, very moist, reddish brown, very silty, gravelly, SAND (SM).
2	
3	Abundant roots 0 to 3 feet. Wet at 3 feet. Becomes medium dense and grayish tan below 3 feet.
4	**Vashon Lodgement Till** Dense, very moist, grayish tan, very silty, gravelly, SAND; scattered cobbles; nonstratified (SM). Mottled 3.5 to 4.5 feet. Becomes very dense below 4.5 feet.
5	
6	
7	
8	
9	Bottom of exploration pit at depth 8 feet Slow seepage at 3 feet. Minor sloughing at 3 feet.
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-32

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	**DESCRIPTION** Elev: ~420 ft
	Topsoil
1	
	Weathered Vashon Lodgement Till
2	Medium dense, moist, orangish brown, silty, fine SAND, trace to some gravel; occasional cobbles; unsorted (SM).
3	**Vashon Lodgement Till**
	Becomes dense and gray.
4	
5	
6	Becomes very dense.
7	
8	
9	
	Bottom of exploration pit at depth 9 feet No seepage. No caving.
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-33

Depth (ft)	**DESCRIPTION** Elev: ~435 ft
	Topsoil
1	**Weathered Vashon Lodgement Till** Loose to medium dense, orangish tan, silty, fine SAND, trace gravel; unsorted (SM).
2	
3	
	Vashon Lodgement Till Becomes dense to very dense, slightly moist, and gray.
4	
5	
6	
7	
8	Bottom of exploration pit at depth 8 feet No seepage. No caving.
9	
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-34

Depth (ft)

DESCRIPTION

Elev: ~445 ft

Topsoil

1

Weathered Vashon Lodgement Till

Loose to medium dense, very moist, orangish brown, silty, fine to medium SAND, trace gravel; occasional cobbles; unsorted (SM).

2

Vashon Lodgement Till

Becomes dense, moist, and gray.

3

4

Becomes very dense.

5

6

Bottom of exploration pit at depth 6 feet
No seepage. No caving.

7

8

9

10

11

12

13

14

15

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EXPLORATION PIT NO. EP-35

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Elev: ~450 ft

Topsoil

1

Weathered Vashon Lodgement Till

Loose to medium dense, very moist, orangish brown, silty, fine SAND, trace gravel; occasional roots; unsorted (SM).

2

3

Vashon Lodgement Till

4

Dense, moist, tan to gray, silty, fine to medium SAND, some gravel; occasional cobbles; unsorted (SM).

5

6

Bottom of exploration pit at depth 6 feet
No seepage. No caving.

7

8

9

10

11

12

13

14

15

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EXPLORATION PIT NO. EP-36

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: ~460 ft
	Topsoil
1	**Weathered Vashon Lodgement Till**
	Loose to medium dense, moist, orangish brown, silty, fine SAND, trace gravel; unsorted (SM).
2	
3	**Vashon Lodgement Till**
	Become dense, tan to gray, and some gravel with occasional cobbles.
4	
5	
6	
7	
8	
9	
10	Frequent cobbles 10 to 12 feet.
11	
12	Bottom of exploration pit at depth 12 feet Slight seepage 10 to 12 feet. No caving.
13	
14	
15	

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EXPLORATION PIT NO. EP-37

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: ~475 ft
0–1.5	**Topsoil**
1.5–3	**Weathered Vashon Lodgement Till** Medium dense, moist, tan, silty, fine to medium SAND, some gravel; cobbles present; unsorted (SM).
3–10	**Vashon Lodgement Till** Becomes dense and tan to gray. Frequent cobbles 4 to 6 feet.
10	Bottom of exploration pit at depth 10 feet No seepage. No caving.

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

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EXPLORATION PIT NO. EP-38

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: ~495 ft
0	**Topsoil**
1	**Weathered Vashon Lodgement Till** Loose to medium dense, very moist, orangish brown, silty, fine SAND, some gravel; unsorted (SM).
2	
2.5	**Vashon Lodgement Till** Dense, moist, tan to gray, silty, fine to medium SAND, some gravel; occasional cobbles; unsorted (SM).
3	
4	
5	
6	
7	Bottom of exploration pit at depth 7 feet No seepage. No caving.
8	
9	
10	
11	
12	
13	
14	
15	

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EXPLORATION PIT NO. EP-39

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

DESCRIPTION

Elev: ~510 ft

Topsoil

1

Blakely Harbor Formation

Medium dense, moist, yellowish tan with orange and black oxidation, silty, gravelly, SAND; gravel fraction consists of angular sandstone fragments (SM).

2

3

Becomes dense.

4

5

6

7

8

9

10

Bottom of exploration pit at depth 10 feet
No seepage. No caving.

11

12

13

14

15

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EXPLORATION PIT NO. EP-40

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: ~520 ft
	Topsoil
1	**Blakely Harbor Formation**
	Very dense, slightly moist, yellowish tan, SAND, some silt to silty; stratified (sandstone) (SP-SM).
2	
3	
	Bottom of exploration pit at depth 3 feet No seepage. No caving.
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

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TEST PIT NUMBER TP-1

PAGE 1 OF 1

CLIENT Plateau Campus, LLC
PROJECT NAME Plateau Campus Property
PROJECT NUMBER 3333
PROJECT LOCATION Issaquah, Washington
DATE STARTED 5/5/14 **COMPLETED** 5/5/14
GROUND ELEVATION ______ **TEST PIT SIZE** ______
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD ______
AT TIME OF EXCAVATION ---
LOGGED BY SHA **CHECKED BY** SSR
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 10": bare soil
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		TOPSOIL
				1.0	Brown silty SAND with gravel, loose to medium dense, moist (Weathered Till)
		MC = 16.90% Fines = 24.00%			-mottled with light iron oxide staining, becomes dense
		MC = 12.50%	SM		-becomes very dense and unweathered, perched seepage
5					
				7.0	Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 4.0 feet during excavation. Bottom of test pit at 7.0 feet.

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TEST PIT NUMBER TP-3

PAGE 1 OF 1

CLIENT Plateau Campus, LLC
PROJECT NAME Plateau Campus Property
PROJECT NUMBER 3333
PROJECT LOCATION Issaquah, Washington
DATE STARTED 5/5/14 **COMPLETED** 5/5/14
GROUND ELEVATION ______ **TEST PIT SIZE** ______
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD ______
AT TIME OF EXCAVATION ---
LOGGED BY SHA **CHECKED BY** SSR
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 12": Ivy
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.0	TOPSOIL
		MC = 15.70% Fines = 29.10% MC = 8.00%	SM		Brown silty SAND with gravel, loose to medium dense, moist (Weathered Till) -heavy perched seepage -becomes very dense and unweathered
5				5.0	Test pit terminated at 5.0 feet below existing grade. Groundwater seepage encountered at 1.5 feet during excavation. Bottom of test pit at 5.0 feet.

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TEST PIT NUMBER TP-4

PAGE 1 OF 1

CLIENT Plateau Campus, LLC
PROJECT NAME Plateau Campus Property
PROJECT NUMBER 3333
PROJECT LOCATION Issaquah, Washington
DATE STARTED 5/5/14 **COMPLETED** 5/5/14
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY SHA **CHECKED BY** SSR
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 18": ivy
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		TOPSOIL
				1.5	Brown silty SAND with gravel, loose and medium dense, moist (Weathered Till)
		MC = 11.80%			
		MC = 12.00%			
					-becomes very dense and unweathered
5			SM		
		MC = 12.10%			
				8.0	Test pit terminated at 8.0 feet below existing grade. Groundwater seepage encountered at 3.5 feet during excavation.
					Bottom of test pit at 8.0 feet.

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TEST PIT NUMBER TP-5

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CLIENT Plateau Campus, LLC		**PROJECT NAME** Plateau Campus Property	
PROJECT NUMBER 3333		**PROJECT LOCATION** Issaquah, Washington	
DATE STARTED 5/5/14	**COMPLETED** 5/5/14	**GROUND ELEVATION**	**TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating		**GROUND WATER LEVELS:**	
EXCAVATION METHOD		**AT TIME OF EXCAVATION** ---	
LOGGED BY SHA	**CHECKED BY** SSR	**AT END OF EXCAVATION** ---	
NOTES Depth of Topsoil & Sod 6": bare soil		**AFTER EXCAVATION** ---	

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION
0			TPSL		0.5	TOPSOIL
						Brown silty SAND with gravel, medium dense, moist (Fill)
		MC = 14.30%				
5			SM			-becomes medium dense to dense
		MC = 16.80%				-native, unweathered till contact
10					10.0	
						Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 10.0 feet.

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TEST PIT NUMBER TP-6

PAGE 1 OF 1

CLIENT Plateau Campus, LLC
PROJECT NAME Plateau Campus Property
PROJECT NUMBER 3333
PROJECT LOCATION Issaquah, Washington
DATE STARTED 5/5/14 **COMPLETED** 5/5/14
GROUND ELEVATION ______ **TEST PIT SIZE** ______
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
AT TIME OF EXCAVATION —
EXCAVATION METHOD ______
AT END OF EXCAVATION —
LOGGED BY SHA **CHECKED BY** SSR
AFTER EXCAVATION —
NOTES Depth of Topsoil & Sod 6": ferns

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION
0		TPSL		0.5	TOPSOIL
		SM			Brown silty SAND with gravel, medium dense, moist (Weathered Till)
					-becomes very dense and unweathered
				4.0	Test pit terminated at 4.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 4.0 feet.

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TEST PIT NUMBER TP-7

PAGE 1 OF 1

CLIENT Plateau Campus, LLC

PROJECT NAME Plateau Campus Property

PROJECT NUMBER 3333

PROJECT LOCATION Issaquah, Washington

DATE STARTED 5/5/14 **COMPLETED** 5/5/14

GROUND ELEVATION ____ **TEST PIT SIZE** ____

EXCAVATION CONTRACTOR NW Excavating

GROUND WATER LEVELS:

EXCAVATION METHOD ____

AT TIME OF EXCAVATION ---

LOGGED BY SHA **CHECKED BY** SSR

AT END OF EXCAVATION ---

NOTES Depth of Topsoil & Sod 12": ferns

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		TOPSOIL
1.0		MC = 15.80%	SM		Brown silty SAND with gravel, medium dense, moist (Weathered Till) -cobbles -becomes very dense and unweathered -cobbles down to terminus of test pit
4.0 5 10		MC = 10.40% Fines = 11.30% MC = 21.60%	GP-GM		Brown poorly graded GRAVEL with silt and sand, dense, moist
13.0					Test pit terminated at 13.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 13.0 feet.

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TEST PIT NUMBER TP-9

PAGE 1 OF 1

CLIENT Plateau Campus, LLC
PROJECT NAME Plateau Campus Property
PROJECT NUMBER 3333
PROJECT LOCATION Issaquah, Washington
DATE STARTED 5/5/14 **COMPLETED** 5/5/14
GROUND ELEVATION ______ **TEST PIT SIZE** ______
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD ______
AT TIME OF EXCAVATION ---
LOGGED BY SHA **CHECKED BY** SSR
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 12": duff
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		TOPSOIL
1.0		MC = 23.20%	SM		Brown silty SAND with gravel, loose to medium dense, moist (Weathered Till) -fractured -cobbles, mottled texture
3.0 5		MC = 17.20%	GP-GM		Brown poorly graded GRAVEL with silt and sand, dense, moist
9.0					Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 9.0 feet.

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TEST PIT NUMBER TP-8

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PROJECT NAME Plateau Campus Property

PROJECT NUMBER 3333

PROJECT LOCATION Issaquah, Washington

DATE STARTED 5/5/14 **COMPLETED** 5/5/14

GROUND ELEVATION ______ **TEST PIT SIZE** ______

EXCAVATION CONTRACTOR NW Excavating

GROUND WATER LEVELS:

EXCAVATION METHOD ______

AT TIME OF EXCAVATION ---

LOGGED BY SHA **CHECKED BY** SSR

AT END OF EXCAVATION ---

NOTES Depth of Topsoil & Sod 10": forest duff

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		TOPSOIL
1.0			SM		Brown silty SAND with gravel, loose to medium dense, moist (Weathered Till)
					-becomes very dense and unweathered -cobbles
5		MC = 19.70%			
8.0					Test pit terminated at 8.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 8.0 feet.

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TEST PIT NUMBER TP-10

PAGE 1 OF 1

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PROJECT NAME Plateau Campus Property

PROJECT NUMBER 3333

PROJECT LOCATION Issaquah, Washington

DATE STARTED 5/5/14 **COMPLETED** 5/5/14

GROUND ELEVATION ________ **TEST PIT SIZE** ________

EXCAVATION CONTRACTOR NW Excavating

GROUND WATER LEVELS:

EXCAVATION METHOD ________

AT TIME OF EXCAVATION ---

LOGGED BY SHA **CHECKED BY** SSR

AT END OF EXCAVATION ---

NOTES Depth of Topsoil & Sod 10": blackberry bushes

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		TPSL	1.0	TOPSOIL
		SM	3.0	Brown silty SAND with gravel, medium dense, moist -cobbles and weathered fractured bedrock
5		GP-GM	5.0	Brown poorly graded GRAVEL with silt and sand, dense, moist
				Test pit terminated at 5.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 5.0 feet.

PRJ19-00008 Attachment 042

LOG OF TEST PIT NO. TP-1

FIGURE A-2

PROJECT NAME: Madison Pointe **PROJ. NO:** T-7252 **LOGGED BY:** CSD

LOCATION: Issaquah, Washington **SURFACE CONDS:** Heavy Understory **APPROX. ELEV:** 466 Feet

DATE LOGGED: July 8, 2015 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
1		Brown silty SAND, fine grained, dry, heavy organic inclusions. (SM) (Topsoil)	Loose			
	1			7.1		
2						
3		Brown silty SAND with gravel, fine to medium grained, dry, roots. (SM)	Medium Dense			
4						
5						
6	2			9.5		
7		Gray silty SAND with gravel to SAND with silt and gravel, fine to medium grained, dry to moist, cemented. (SM/SP-SM)	Very Dense			
8						
9						
10						
11		Test pit terminated at approximately 10 feet. No groundwater seepage observed.				
12						
13						
14						
15						

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-2

FIGURE A-3

PROJECT NAME: Madison Pointe **PROJ. NO:** T-7252 **LOGGED BY:** CSD

LOCATION: Issaquah, Washington **SURFACE CONDS:** Heavy Understory **APPROX. ELEV:** 464 Feet

DATE LOGGED: July 8, 2015 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
1		Brown silty SAND, fine grained, dry, heavy organic inclusions. (SM) (Topsoil)	Loose			
2 3	1	Brown silty SAND with gravel, fine to medium grained, dry, roots. (SM)	Medium Dense	9.2		
4 5	2	Gray silty SAND with gravel, fine to medium grained, dry, cemented. (SM)	Dense	6.5		
6 7 8 9 10	3	Gray silty SAND with gravel to SAND with silt and gravel, fine to medium grained, moist, cemented. (SM/SP-SM)	Very Dense	8.1		
11 12 13 14 15		Test pit terminated at approximately 10 feet. No groundwater seepage observed.				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-3

FIGURE A-4

PROJECT NAME: Madison Pointe **PROJ. NO:** T-7252 **LOGGED BY:** CSD

LOCATION: Issaquah, Washington **SURFACE CONDS:** Moderate Understory **APPROX. ELEV:** 438 Feet

DATE LOGGED: July 8, 2015 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** 0 to 3 Feet

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
		(6 inches ORGANICS)				
1	1	Brown silty SAND with gravel to SAND with silt and gravel, fine to medium grained, dry, roots. (SM/SP-SM)	Medium Dense	5.7		
2						
3						
4						
5	2			4.9		
6		Gray silty SAND with gravel to SAND with silt and gravel, fine to medium grained, dry to moist, cemented, occasional cobble. (SM/SP-SM)	Very Dense			
7						
8						
9		Test pit terminated at approximately 9 feet. No groundwater seepage observed. Minor caving observed in the upper 3 feet.				
10						
11						
12						
13						
14						
15						

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-4

FIGURE A-5

PROJECT NAME: Madison Pointe **PROJ. NO:** T-7252 **LOGGED BY:** CSD

LOCATION: Issaquah, Washington **SURFACE CONDS:** Minimal Understory **APPROX. ELEV:** 480 Feet

DATE LOGGED: July 8, 2015 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
		Brown silty SAND, fine grained, dry, heavy organic inclusions. (SM) (Topsoil)	Loose			
1						
2	1	Gray silty SAND with gravel, fine to medium grained, dry, some roots. (SM)	Dense	9.7		
3						
4						
5	2			23.7		
6						
7		Gray SILTSTONE, moist.	Very Dense			
8						
9	3			25.1		
10		Test pit terminated at approximately 10 feet. No groundwater seepage observed.				
11						
12						
13						
14						
15						

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-5

FIGURE A-6

PROJECT NAME: Madison Pointe **PROJ. NO:** T-7252 **LOGGED BY:** CSD

LOCATION: Issaquah, Washington **SURFACE CONDS:** Moderate Understory **APPROX. ELEV:** 490 Feet

DATE LOGGED: July 8, 2015 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
		Brown silty SAND, fine grained, dry, heavy organic inclusions. (SM) (Topsoil)	Loose			
1						
2	1	Brown silty SAND with gravel, fine to medium grained, dry, large roots. (SM)	Medium Dense	9.0		
3						
4						
5						
6	2	Gray-brown silty SAND mixed with pieces of weathered SANDSTONE, fine to medium grained, dry, cobbles. (SM)	Very Dense	11.6		
7						
8		*Sandstone pieces increase with depth, by 9 feet became difficult to excavate with 125 machine				
9		Test pit terminated at approximately 9 feet. No groundwater seepage observed.				
10						
11						
12						
13						
14						
15						

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-6

FIGURE A-7

PROJECT NAME: Madison Pointe **PROJ. NO:** T-7252 **LOGGED BY:** CSD

LOCATION: Issaquah, Washington **SURFACE CONDS:** Brush/Weeds **APPROX. ELEV:** 520 Feet

DATE LOGGED: July 8, 2015 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
	1	(less than 1" ORGANICS) FILL: gray sandy silt, fine grained, dry, roots, minor construction debris, large piece of concrete.	Medium Dense	11.0		
1		Black silty SAND, fine to medium grained, dry, roots, heavy organic inclusions. (SM) (Topsoil)	Medium Dense			
2						
3						
4	2		Dense	56.0		
5						
6		Red-brown SILTSTONE, very weathered, some cobbles, occasional boulders.				
7						
8						
9		@-9' material becomes less weathered, larger pieces	Very Dense			
10	3			46.6		
		Test pit terminated at approximately 10 feet. No groundwater seepage observed.				
11						
12						
13						
14						
15						

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-7

FIGURE A-8

PROJECT NAME: Madison Pointe **PROJ. NO:** T-7252 **LOGGED BY:** CSD

LOCATION: Issaquah, Washington **SURFACE CONDS:** Heavy Understory **APPROX. ELEV:** 516 Feet

DATE LOGGED: July 8, 2015 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
1		Brown silty SAND, fine grained, dry, heavy organic inclusions. (SM) (Topsoil)	Loose			
2	1	Brown silty SAND with gravel, fine to medium grained, dry, roots. (SM)	Medium Dense	8.0		
3						
4		Gray silty SAND with gravel to SAND with silt and gravel, fine to medium grained, dry, cemented. (SM/SP-SM)	Dense			
5	2			5.9		
6						
7		Test pit terminated at approximately 7 feet. No groundwater seepage observed.				
8						
9						
10						
11						
12						
13						
14						
15						

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-8

FIGURE A-9

PROJECT NAME: Madison Pointe **PROJ. NO:** T-7252 **LOGGED BY:** CSD

LOCATION: Issaquah, Washington **SURFACE CONDS:** Moderate Understory **APPROX. ELEV:** 482 Feet

DATE LOGGED: July 8, 2015 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
1		Brown silty SAND, fine grained, dry, heavy organic inclusions. (SM) (Topsoil)	Loose			
2	1			5.3		
3		Brown SAND with silt and gravel, fine to medium grained, dry, roots. (SP-SM)	Medium Dense			
4						
5			Dense			
6						
7	2	Gray silty SAND with gravel, fine to medium grained, dry to moist, cemented, some cobbles/boulders. (SM/SP-SM)	Very Dense	12.7		
8						
9	3	Red-brown SANDSTONE, moist, weathered, difficult to excavate.	Very Dense	10.7		
10		Test pit terminated at approximately 10 feet. No groundwater seepage observed.				
11						
12						
13						
14						
15						

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-9

FIGURE A-10

PROJECT NAME: Madison Pointe **PROJ. NO:** T-7252 **LOGGED BY:** CSD

LOCATION: Issaquah, Washington **SURFACE CONDS:** Moderate Understory **APPROX. ELEV:** 482 Feet

DATE LOGGED: July 8, 2015 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
1		Brown silty SAND, fine grained, dry, heavy organic inclusions. (SM) (Topsoil)	Loose			
2	1	Brown silty SAND with gravel, fine to medium grained, dry, roots. (SM)	Medium Dense	7.2		
3						
4						
5		Gray silty SAND with gravel to SAND with silt and gravel, fine to medium grained, dry to moist, some cementation, occasional cobble/boulder. (SM/SP-SM)				
6	2			8.0		
7			Very Dense			
8		*Soil becomes less cemented with depth.				
9	3	*At 9 feet soil becomes wet.		11.6		
10						
11		Test pit terminated at approximately 11 feet. No groundwater seepage observed.				
12						
13						
14						
15						

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-10

FIGURE A-11

PROJECT NAME: Madison Pointe **PROJ. NO:** T-7252 **LOGGED BY:** CSD

LOCATION: Issaquah, Washington **SURFACE CONDS:** Moderate Understory **APPROX. ELEV:** 503 Feet

DATE LOGGED: July 8, 2015 **DEPTH TO GROUNDWATER:** N/A **DEPTH TO CAVING:** N/A

DEPTH (FT.)	SAMPLE NO.	DESCRIPTION	CONSISTENCY/ RELATIVE DENSITY	W (%)	POCKET PEN. (TSF)	REMARKS
1		Brown silty SAND, fine grained, dry, heavy organic inclusions. (SM) (Topsoil)	Loose			
2	1	Brown silty SAND with gravel, fine to medium grained, dry, roots. (SM)	Medium Dense	5.9		
3						
			Dense			
4						
			Very Dense			
5	2			9.6		
6						
7		Gray silty SAND with gravel, fine to medium grained, dry to moist, cemented, occasional cobble. (SM)				
8						
9						
10						
11		Test pit terminated at approximately 11 feet. No groundwater seepage observed.				
12						
13						
14						
15						

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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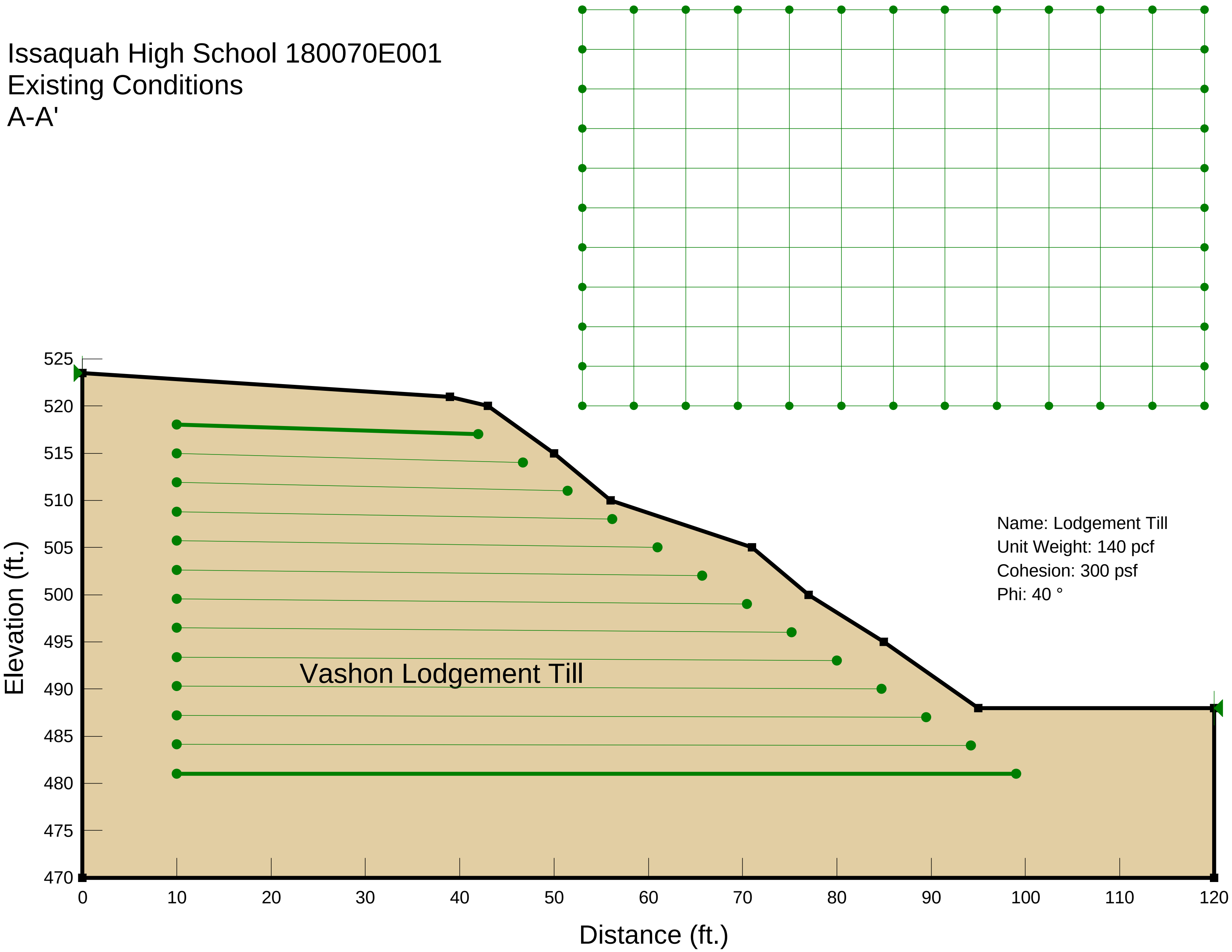
APPENDIX B

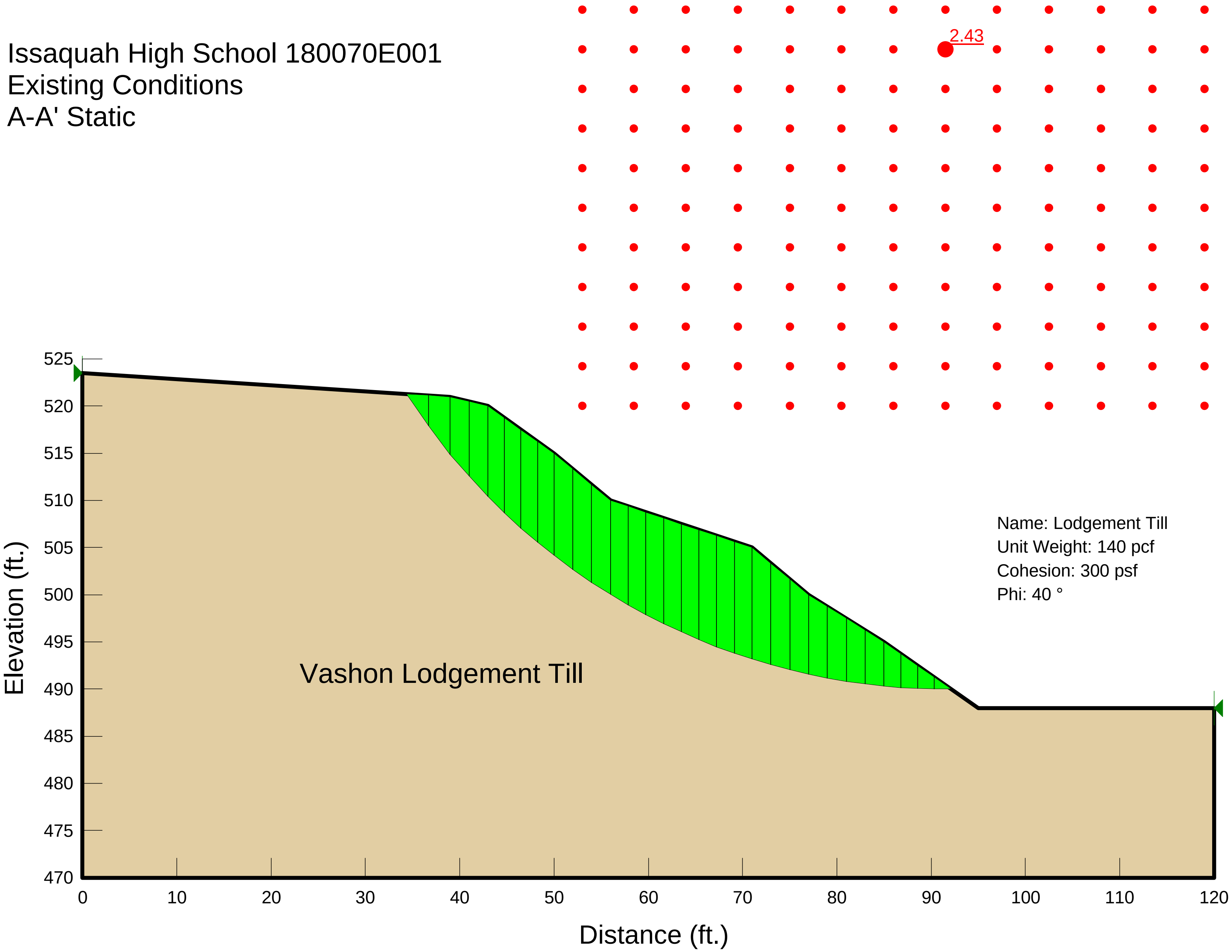
SLOPE/W Profiles

PRJ19-00008 Attachment 042

Issaquah High School 180070E001
Existing Conditions
A-A'

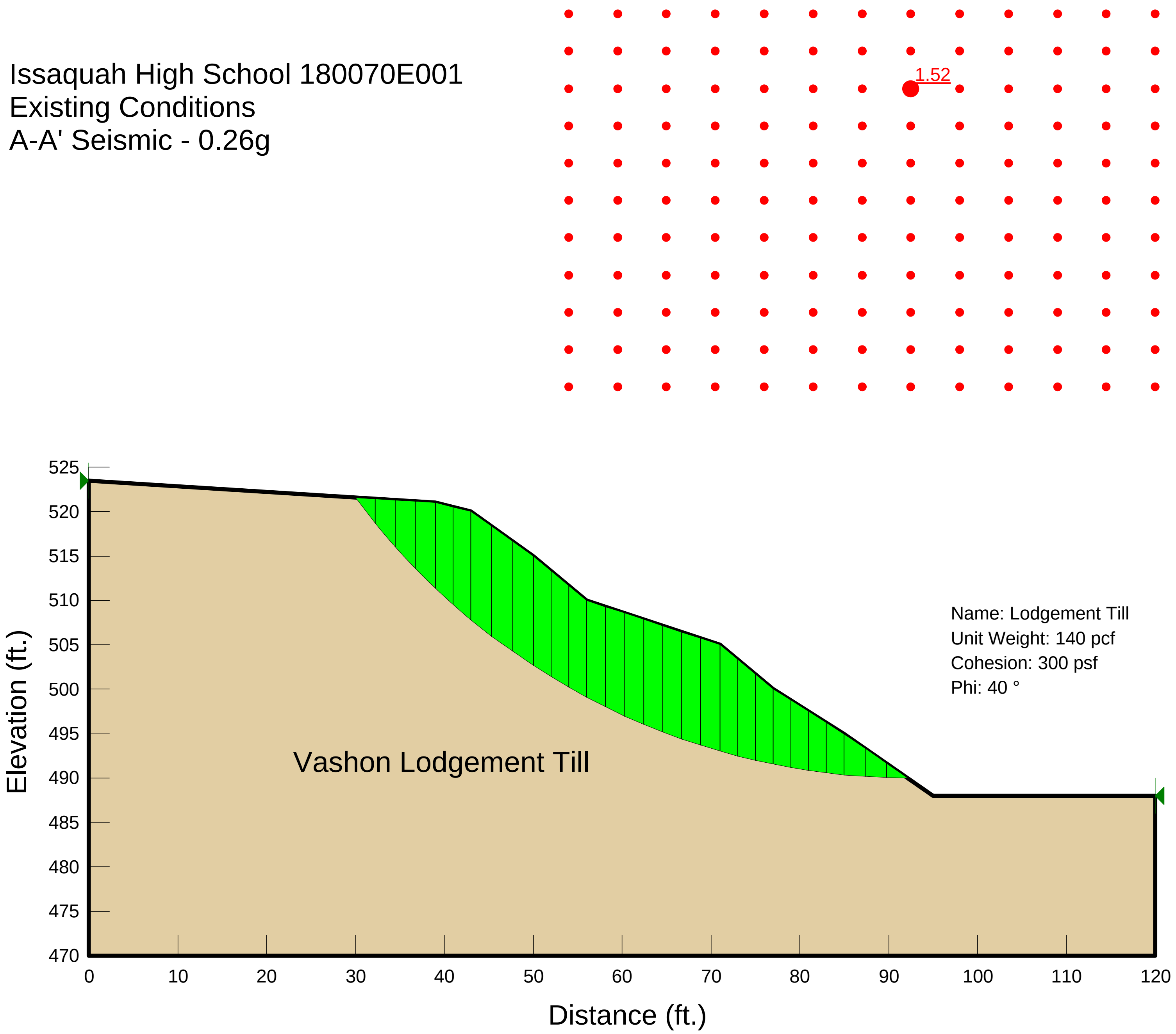


Issaquah High School 180070E001
Existing Conditions
A-A' Static

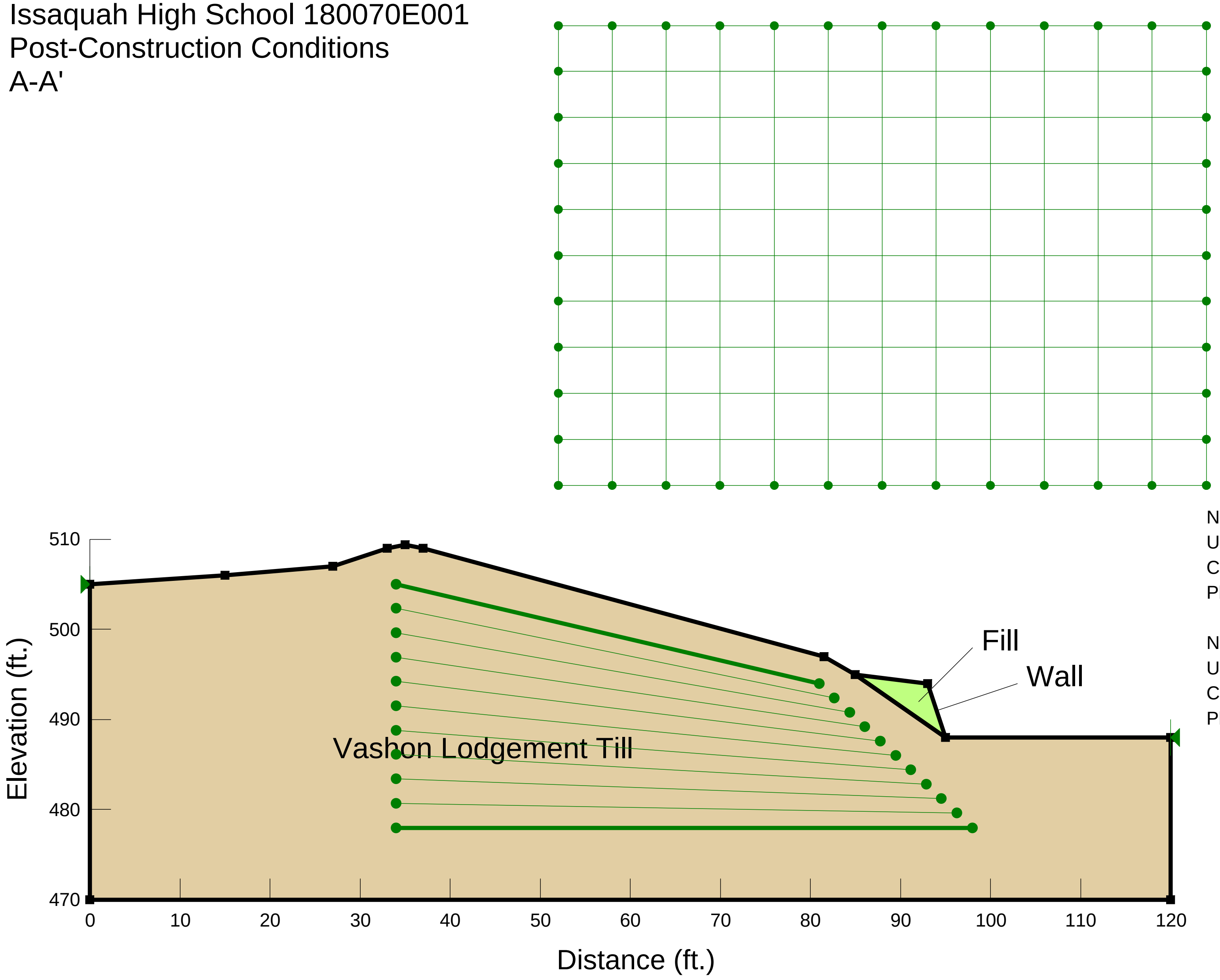


PRJ19-00008 Attachment 042

Issaquah High School 180070E001
Existing Conditions
A-A' Seismic - 0.26g



Issaquah High School 180070E001
Post-Construction Conditions
A-A'

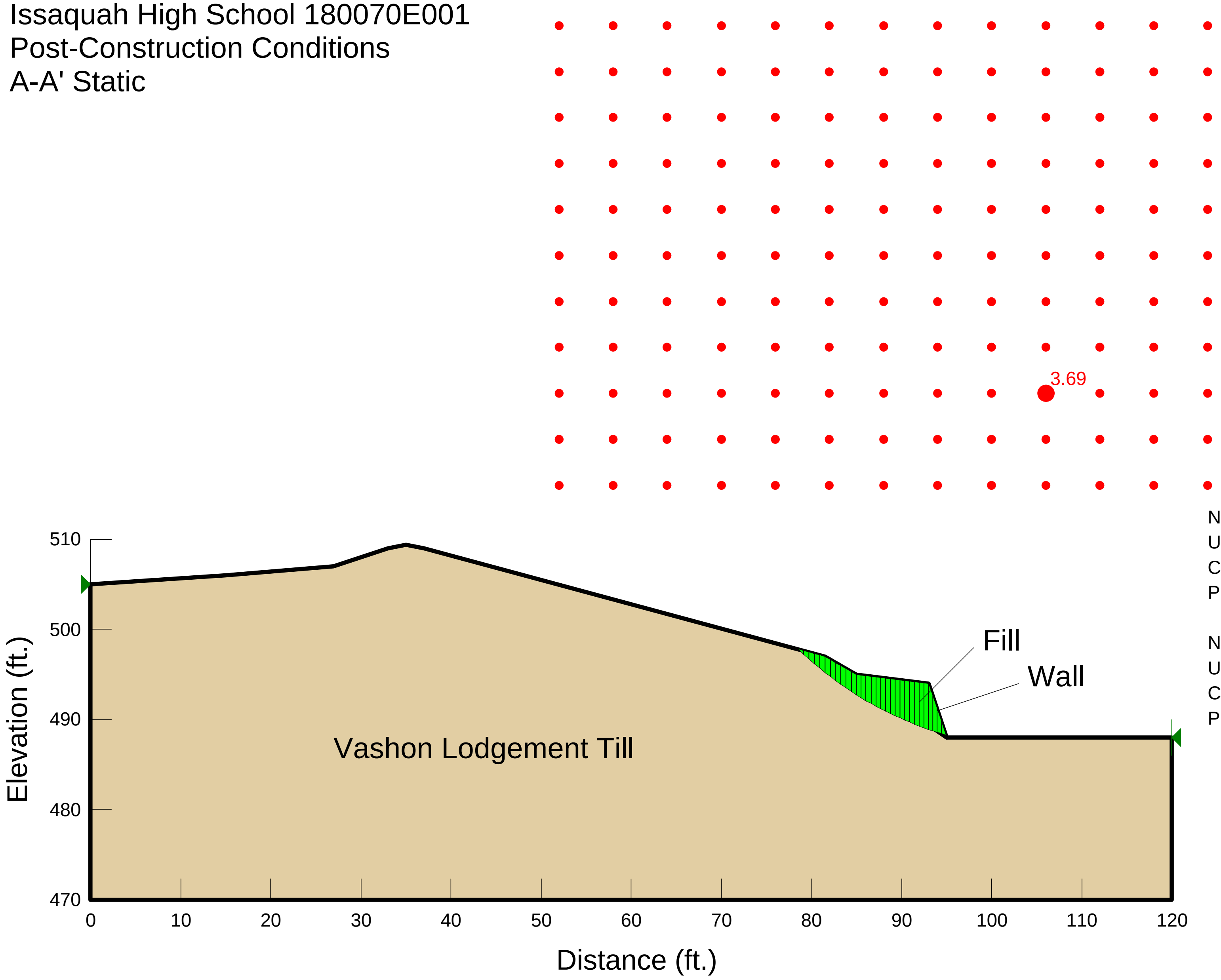


Name: Lodgement Till
Unit Weight: 140 pcf
Cohesion: 300 psf
Phi: 40 °

Name: Fill
Unit Weight: 125 pcf
Cohesion: 50 psf
Phi: 32 °

PRJ19-00008 Attachment 042

Issaquah High School 180070E001
Post-Construction Conditions
A-A' Static

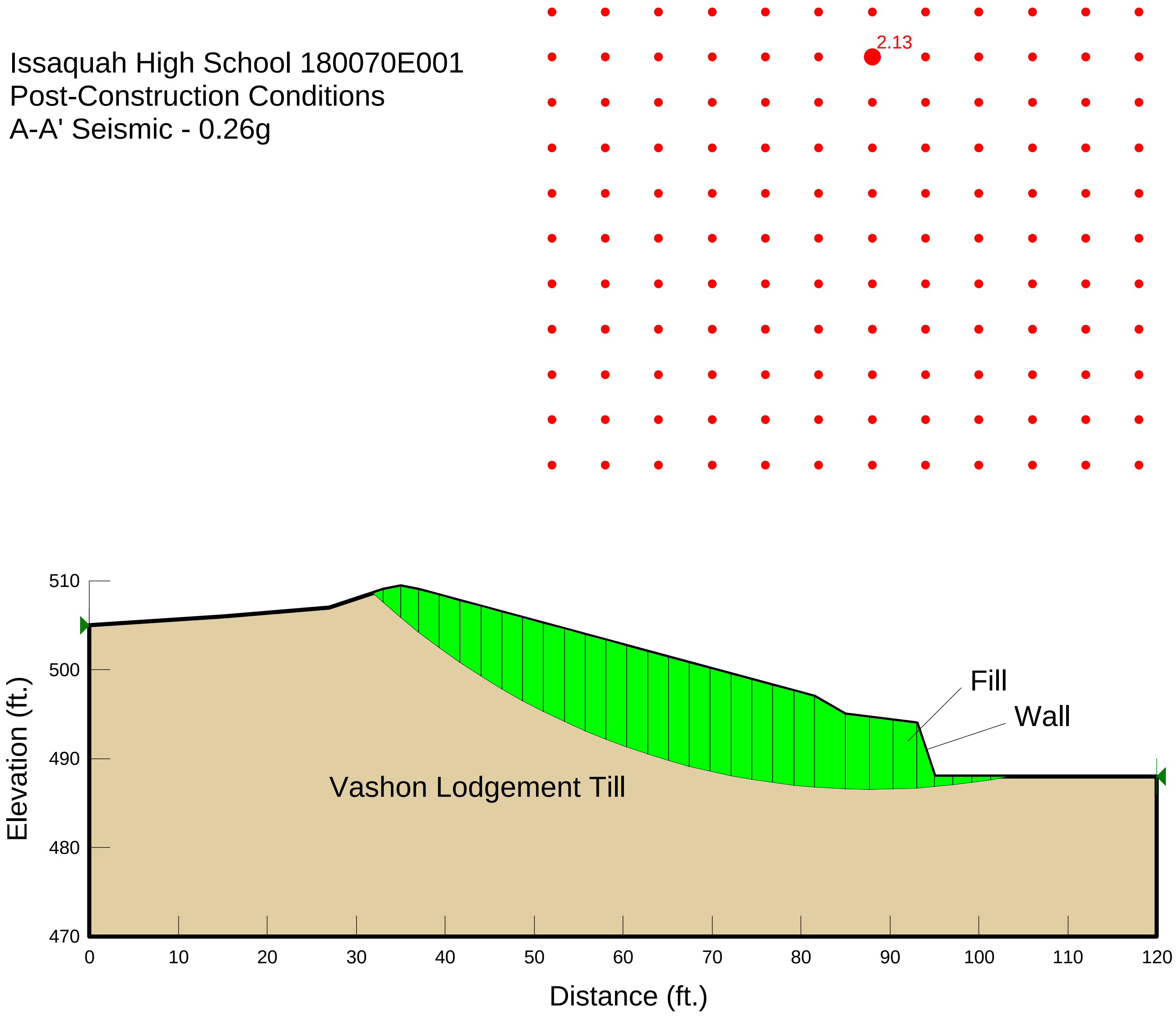


Name: Lodgement Till
Unit Weight: 140 pcf
Cohesion: 300 psf
Phi: 40 °

Name: Fill
Unit Weight: 125 pcf
Cohesion: 50 psf
Phi: 32 °

PRJ19-00008 Attachment 042

Issaquah High School 180070E001
Post-Construction Conditions
A-A' Seismic - 0.26g

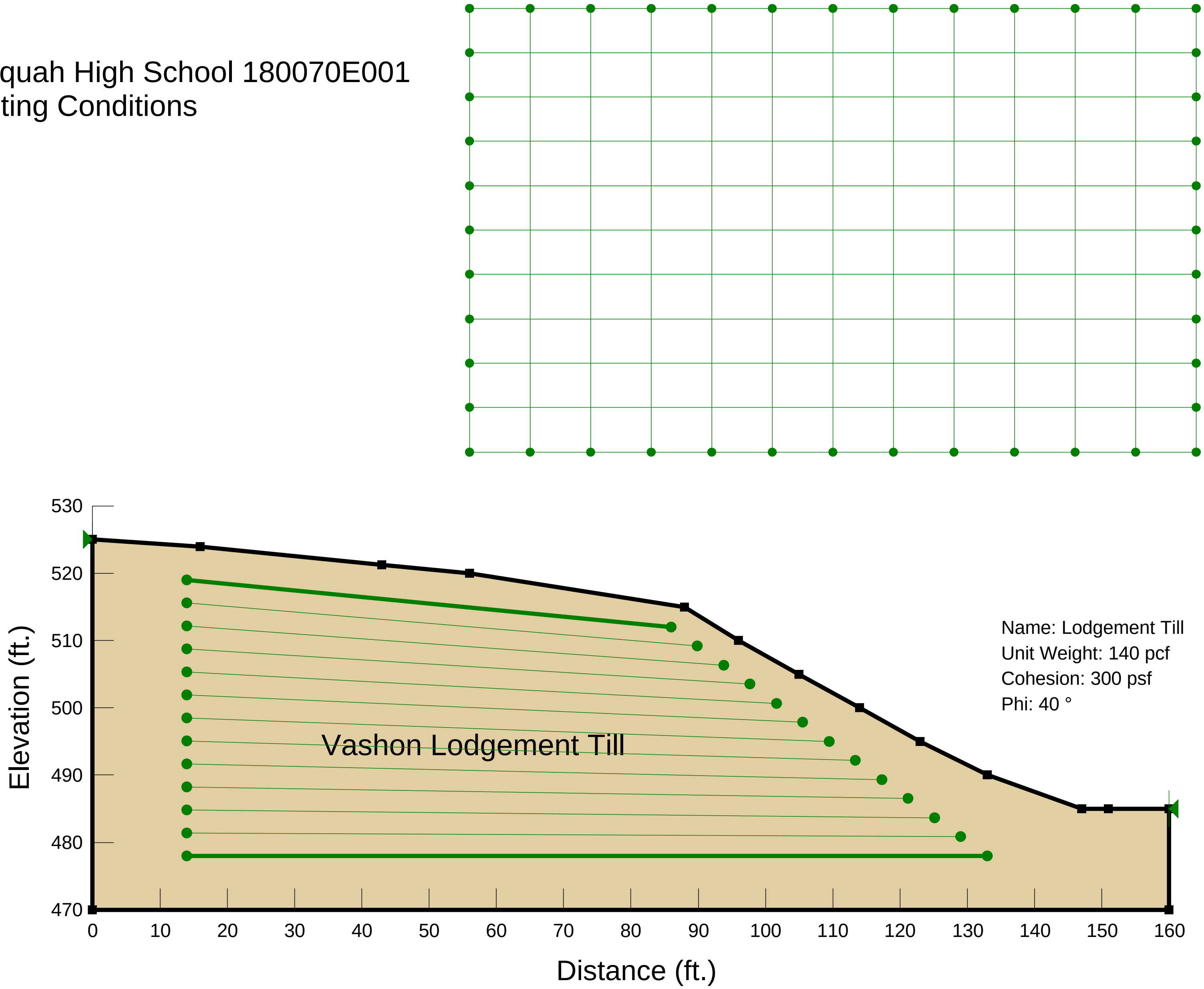


Name: Lodgement Till
Unit Weight: 140 pcf
Cohesion: 300 psf
Phi: 40 °

Name: Fill
Unit Weight: 125 pcf
Cohesion: 50 psf
Phi: 32 °

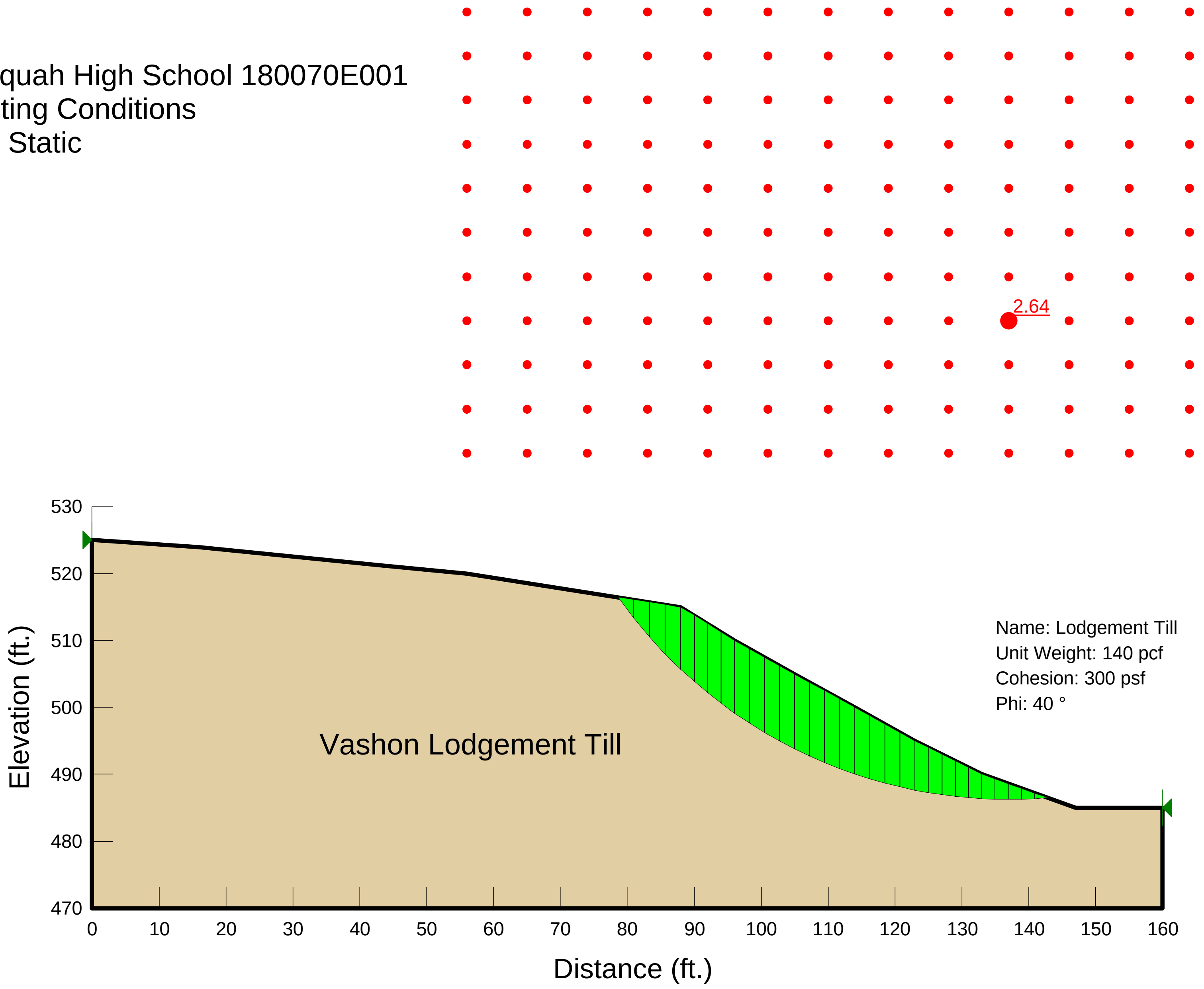
PRJ19-00008 Attachment 042

Issaquah High School 180070E001
Existing Conditions
B-B'



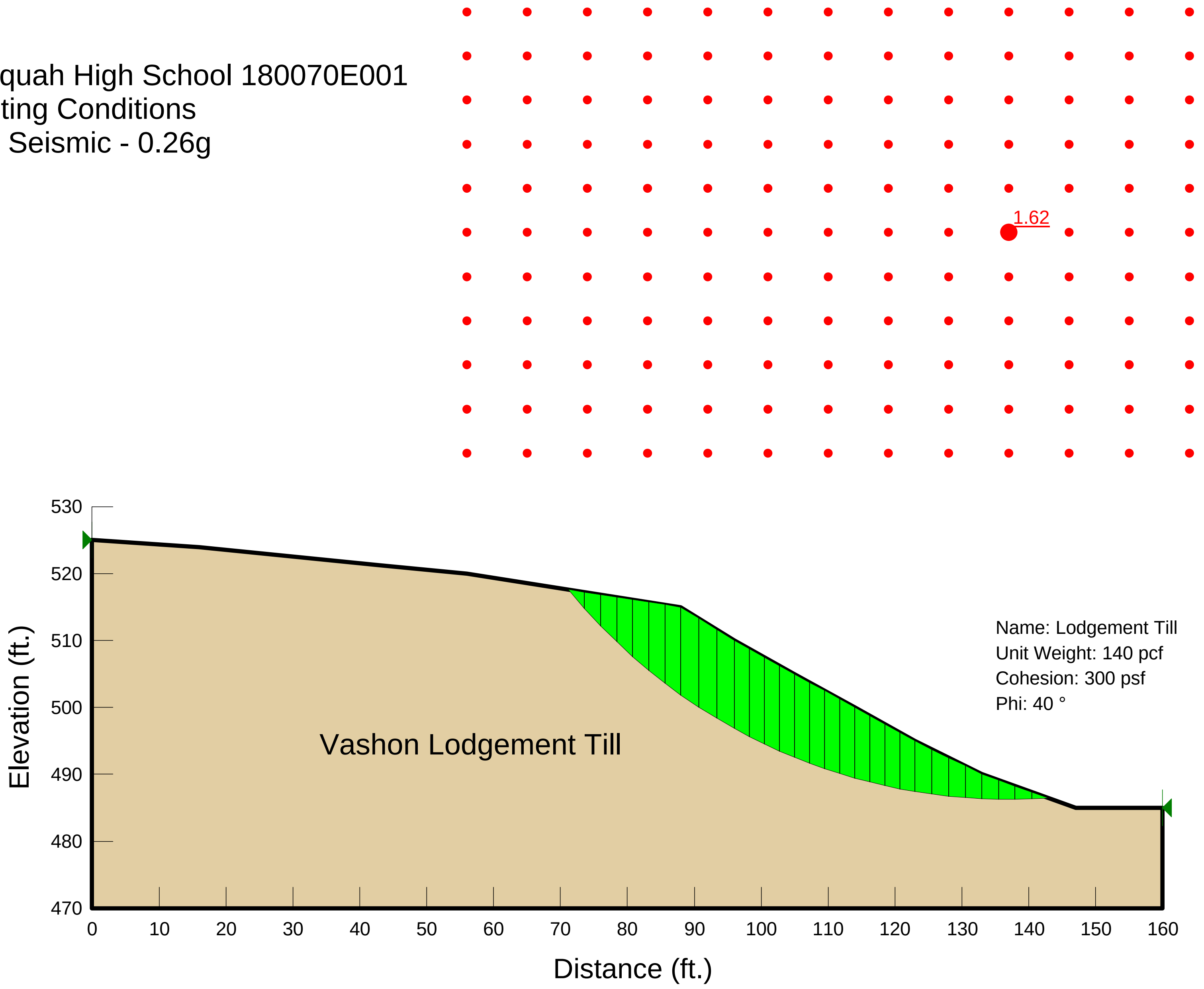
PRJ19-00008 Attachment 042

Issaquah High School 180070E001
Existing Conditions
B-B' Static



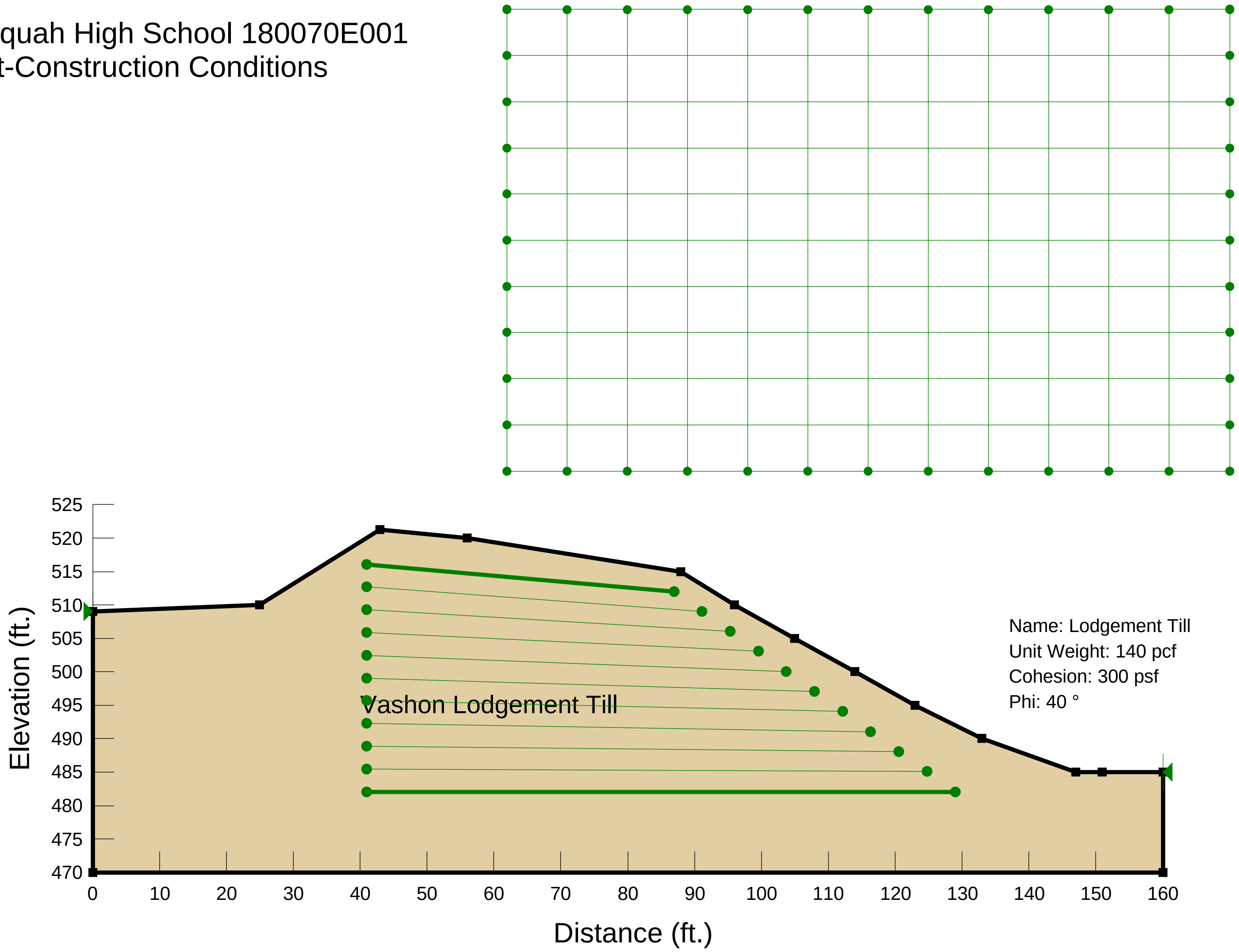
PRJ19-00008 Attachment 042

Issaquah High School 180070E001
Existing Conditions
B-B' Seismic - 0.26g



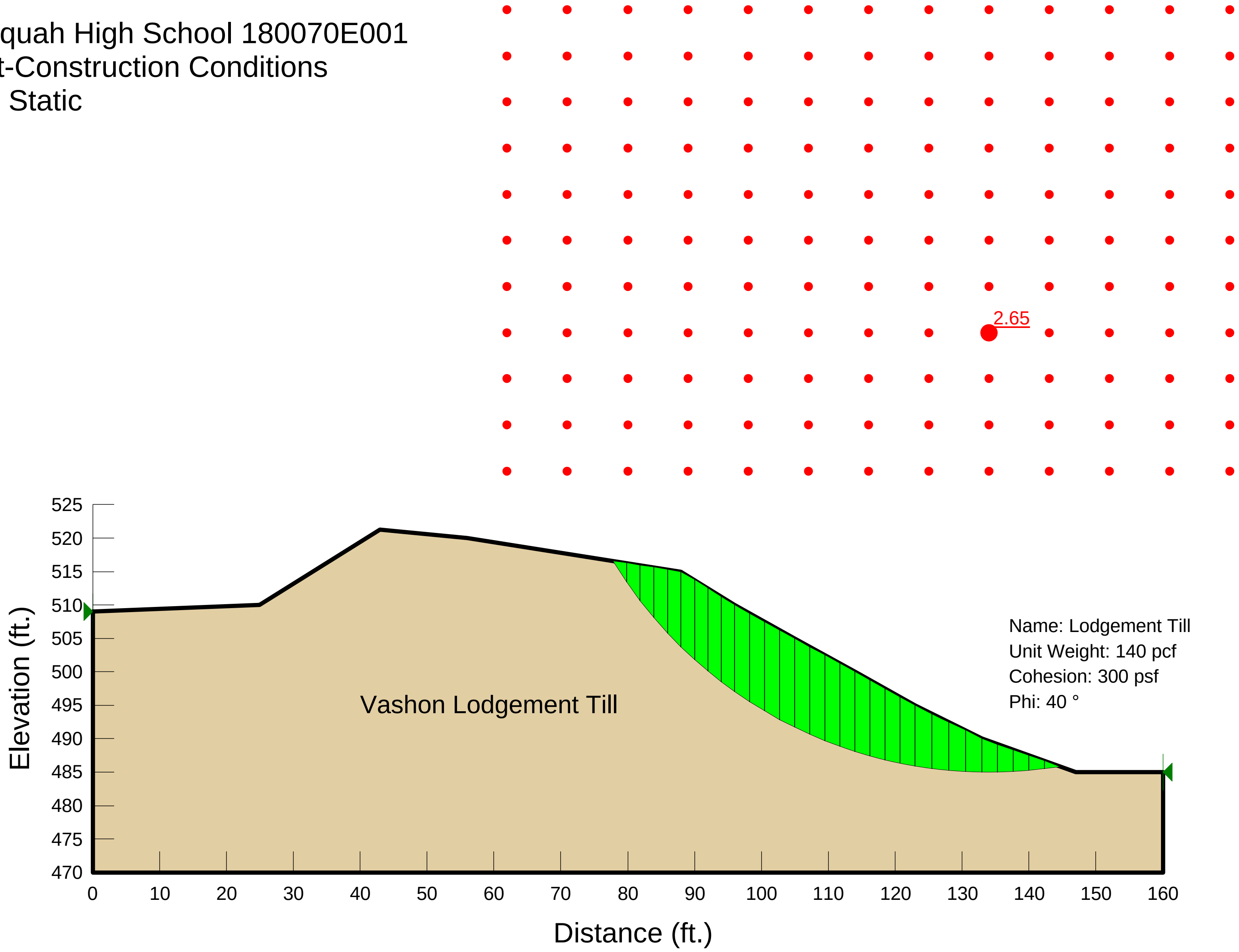
PRJ19-00008 Attachment 042

Issaquah High School 180070E001
Post-Construction Conditions
B-B'



PRJ19-00008 Attachment 042

Issaquah High School 180070E001
Post-Construction Conditions
B-B' Static



Name: Lodgement Till
Unit Weight: 140 pcf
Cohesion: 300 psf
Phi: 40 °

Issaquah High School 180070E001
Post-Construction Conditions
B-B' Seismic - 0.26g